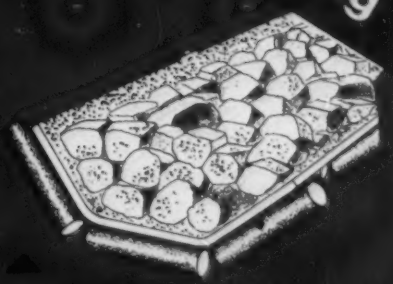
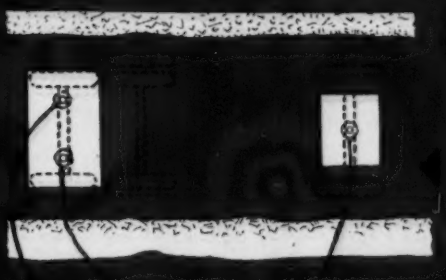
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION OCTOBER 1959 PRICE ONE DOLLAR FOUNDED 1866

Materials Handling

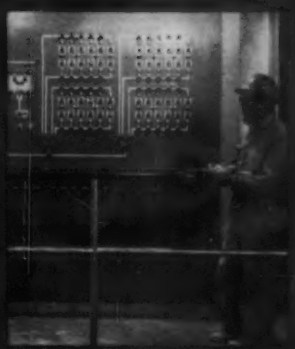


A NEW BELT designed for ores can operate well on 45-deg idlers . . . . . p 102

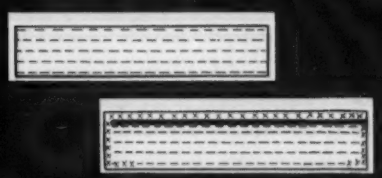


TRUCK WEIGHING at Wagontown, Inc. proves its accuracy . . . . . p 95

CANMET uses mobile cyclones to build a tailings dam . . . p 84



TACONITE additives are conveyed by air at the plant . . . p 92



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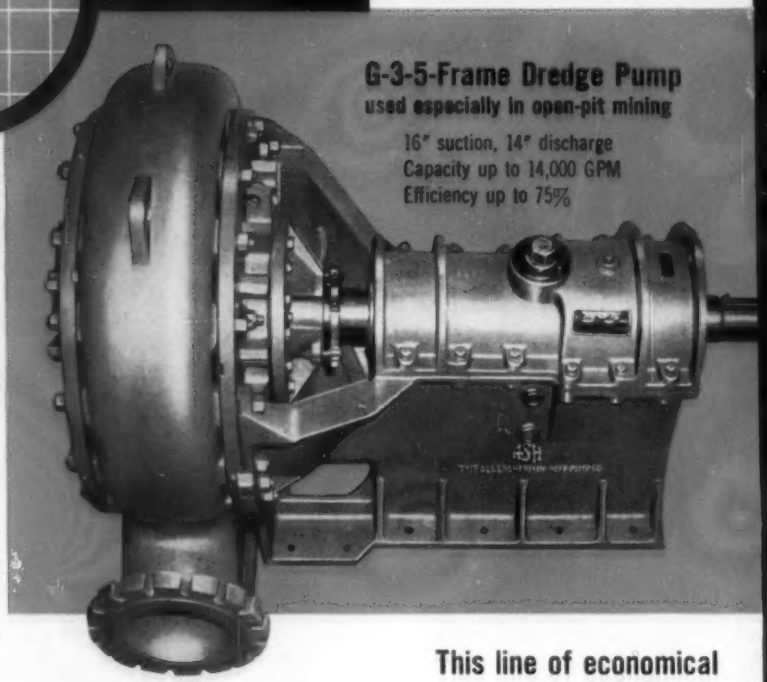
For pumping abrasives over 1/4" diameter

Write for ILLUSTRATED **Brochure No. 657**



G-3-5-Frame Dredge Pump
used especially in open-pit mining
16" suction, 14" discharge
Capacity up to 14,000 GPM
Efficiency up to 75%

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SAND & DREDGE TYPE
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Since solids over ¼" diam. do not bounce off but tend to tear rubber, these pumps have their impellers, shells and suction sleeves made of the alloy most resistant under the wearing conditions. Yet, they have the life-long high efficiency and the power-saving ability that are characteristic of Hydroseal rubber-lined pumps. This is due to the Hydrosealing principle of gland protection by clear liquid under pressure, and to the patented axial adjustment for proper clearance of wearing parts. According to use, replaceable side bell liners may be of rubber or metal. Write us about your pumping problem.

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1¼" capacity

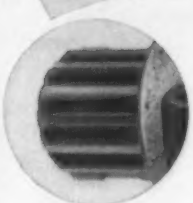
25% more power!

6¾ inches shorter!

7 pounds lighter!

than the size 534

optional features



Spline Drive Anvil

For transmission of maximum power to the socket, many prefer the spline drive which is optional. The closer fit and greater driving area also provide increased socket life.

Swivel Inlet Assembly

Where extreme maneuverability is a problem, the optional swivel inlet assembly makes the hose easier to handle.

Inside Trigger Handle

Preferred by some operators, the optional inside trigger handle prevents the possibility of the operator's hand being caught when the tool is used in extremely close quarters.

for faster run-down, easier operation and better maneuverability in tight spots . . .

MOTOR Powerful new vane-type motor with direct drive to hammer provides greater torque and five times faster run-down. Motor housing is machined from a strong, lightweight alloy.

IMPACT MECHANISM New design operates at maximum efficiency to tighten the toughest nuts and bolts. Rated capacity, 1¼" thread size. No kick or twist is transmitted to the operator.

THROTTLE VALVE Graduated-action throttle valve permits quick homing of socket on nut. Rubber face provides positive seal; can be quickly and economically replaced when necessary.

FREE! New Form 5248—describes the Ingersoll-Rand 834 Impactool in detail. Contains photos, specifications and lists standard and optional equipment and accessories.

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Ingersoll-Rand

Tools plus AIRengineering increase output per man

ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

OCTOBER 1959

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B.F.Goodrich

Belt takes a giant step

B.F.Goodrich improvements in rubber brought extra savings

POURING up that steep grade is a never-ending stream of rock—waste from the coal preparation plant in the valley. It's carried by a conveyor belt, at the rate of 400 tons an hour, almost a third of a mile to the top of that 500-foot high ridge. Ordinarily it would take at least three or more belts to lift heavy loads like this so far. But this B.F.Goodrich belt does it in one hop—and at a terrific saving.

In this exclusive B.F.Goodrich conveyor belt design, individual steel cords run lengthwise in the belt. Each cord is completely surrounded and cushioned by rubber so that it can stand the impact of heavy loads. These parallel cords give tremendous strength, yet are flexible so that troughing is natural.

Because of its steel cord construction, the B.F.Goodrich belt can do the job of three or four belts on this high lift, long distance installation. It eliminates the transfer points necessary with a conveyor system built in several stages with ordinary belts, saving money on the original installation and in reduced maintenance costs.

This B.F.Goodrich steel cord belt has been in operation nearly two years and is expected to give many more years of service. A similar belt carrying ore on the Iron Range is in its 11th season, has lasted longer than any conveyor belt ever made with steel cords or cables.

Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he can answer your questions about the many rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-691, Akron 18, Ohio.*

B.F.Goodrich *conveyor belts*

Behind the By-Lines...

If materials handling is part of your problem, we've got some ammunition aboard to help in the battle.

The flow of material from mine or pit through the plant to the market involves a large part of the cost of mining today, and represents a relatively vulnerable link. A pile-up anywhere along the line can mean downtime, idle crews and lost output.

The range of subjects in this issue is wide, but the information is pertinent.

A truck weighing scheme, designed by mine personnel at Inspiration Consolidated Copper Co.'s mine in Arizona (p 95) is one of the items on the main course. Not only does it represent increased accuracy in weighing performance—it also solves some of the bedding and setup problems which can interfere with the full use of the scale as a tool of everyday procedure.

We'd also suggest for your perusal the brief story on pneumatic conveying of bentonite, coal and soda ash at one of the nation's great taconite plants that begins on p 92. It's an interesting solution to the handling of hygroscopic materials in large volume.

On our visit-before-last to Blind River, in Ontario, Can-Met Explorations was in the process of sinking the shaft. A lot had changed by the time we got back up that way this past summer. There'll be more on the area coming in future issues, but we chose the Can-Met tailings dam item for this issue.

It, too, is materials handling, but with a twist. Because there is almost no soil in the area, Can-Met was faced with a problem in building its tailings dam. The answer was using the tailings themselves, with a set of cyclones for dewatering.

But our Canadian friends didn't stop there. They've designed a setup that almost walks along the dam, building as it goes. The story, from empirical design to conquered obstacles, begins on p 84.

And, of course, when you talk about materials handling in the mining industry, you must cover the conveyor belt.

The pun wasn't intentional, but we have covered covers, too. On p 89, the discussion of conveyor belt maintenance and repair begins, listing danger points and potential trouble spots, citing causes of undue wear and breakdown, and recommending procedures for your own maintenance. The consensus is careful following of the manufacturer's recommendations, and frequent inspection. There's also a short primer on belt design and construction, with advantages and disadvantages of given materials.

Our conveyor belt story continues in an article on p 101, where the National Safety Council lists precautions against underground fires at the conveyor and makes some other suggestions for safe practice.

A new belt design, which the manufacturer feels will cut mine costs and increase capacity, is outlined on p 102 in a story concerning the use of 45° idlers for heavy materials. The new belt is the secret.

To wind up our materials handling coverage, we've taken a talk prepared on one of the vital points in the field; feeding, blending and proportioning.

The story beginning on p 96 is a short course in feeders, with emphasis on control and performance. If the cover drawing which resembles a confused earthworm seems a little strange, the answer is to be found here.

It's a good thing, in these terribly crowded and complex times, that everyone is still patient and polite. We're particularly grateful to Walter M. Chapman of National Lead's Titanium Division at Tahawus, and Miss Jacqueline Gonnet, of the Research Department of AVIATION WEEK, a McGraw-Hill magazine which operates from the same building which houses your humble and obedient servants.

The story begins in E&MJ, on page 81 of the August issue, when we discussed the laudable activities of the JETS, the Junior Engineering Technical Society, which we called "A 4-H Club of Engineering." We offered more material on the subject for the asking.

Mr. Chapman asked.

Unfortunately, through the arcane avenues and byways of mail handling, and the hasty glancing at salutations which is a part of our time, Mr. Chapman's request for "information on JETS" got to AVIATION WEEK instead of to us. He had addressed it properly, it was after the letter got here that the unmeshing occurred.

Enter Miss Gonnet, courteous and prompt. She informed Mr. Chapman, after thanking him for his letter, that her magazine published a great deal of information on jets, and could he please be a little more specific in his request?

Mr. Chapman, with an awesome and truly marvelous patience, replied that there had been some confusion, thanked Miss Gonnet, and asked if she'd please pass along the first request. She has.

Thank you, Miss Gonnet, thank your Mr. Chapman, thank you all.

We've been troubled, lately, by the feeling that the people who write radio and television commercials are trying to tell us something, but they're just not getting through.

It started some time ago, and we weren't bothered over much at first, but now it's getting serious. We stared at the ceiling last week for about ten minutes after a toothy individual informed us that his sponsor's product would clean "a large 9x12 rug." Is a large 9x12 rug larger than an ordinary 9x12 rug? Is there such a thing as a small 9x12 rug? Is this all a plot by foreign agents to strike at our sanity?

And then there's all those independent laboratories that conduct "actual tests." Obviously, the man with the teeth and the confidential tone feels that an actual test is superior to an ordinary laboratory test, but we still don't get it.—And we're living in fear of the day when our curious No. 1 son asks us for the difference between the two. It's coming, sure as shootin'.—And we're just not ready.

But the minor palpitations had been bearable. We survived "the true facts" about one product and even were able to accept a joint effort of two "co-partners." That is, until the latest blow fell. We have recently learned that, during the vacation period, a celebrity took over a show as "guest host." That tears it.

Special report to Caterpillar D8 Tractor owners:

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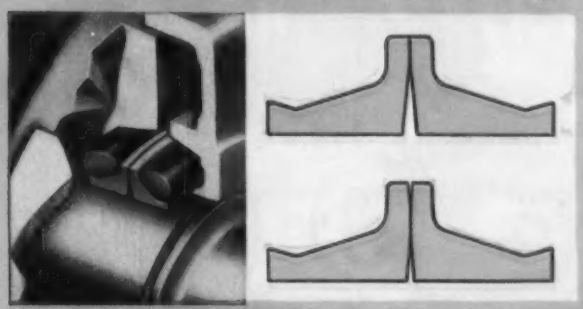
Parts you can trust.
Dependable round-the-clock service.

NOW—YOU CAN EQUIP YOUR D8 WITH LIFETIME LUBRICATED ROLLERS

AVAILABLE FOR 2U, 13A, 14A AND 15A MODELS

Forget about lubrication . . . and seal replacement. They're eliminated by this new concept in roller design and performance. The new lifetime lubricated rollers are lubricated when installed on your tractor. They'll never need lubrication until the rollers are disassembled for rim and flange rebuilding. The seals do not leak even after thousands of hours of operation. Seals won't need replacement when rollers are rebuilt. Another advantage—*oil* lubricant rather than grease is used because oil dissipates heat faster. Rollers operate at cooler temperatures. Bearings last longer.

Now floating ring seal . . . wear does not decrease efficiency. The roller seal employs two metal alloy and two rubber "O" rings. The metal rings, much harder than file steel, have



lapped faces . . . smoother than glass. These faces taper slightly toward the inner edge forming a sealing area at the outer edge. As wear occurs, the sealing area moves inward, maintaining a perfect seal through thousands of hours.

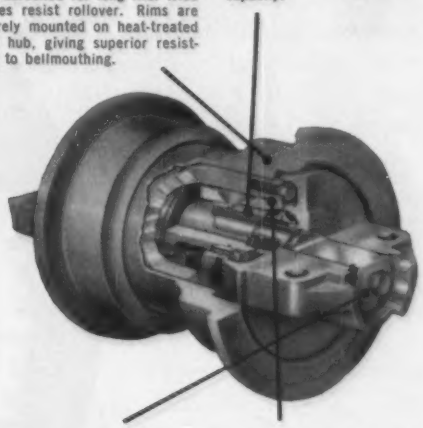
The "O" rings keep constant pressure on the metal rings. Lubricant can't get out. Grit can't get in. There are no springs or diaphragms to weaken, wear or become damaged. "O" rings are made of special compound to resist oil, heat and cold.

Millions of hours of proof—the toughest track roller yet. Cat lifetime lubricated rollers have been subjected to extensive and exhaustive on-the-job tests *for over 5 years*. Working under all types of job conditions, these time-tested rollers have proven unequalled. Their success is further amplified by new machine owner reports—for low-cost performance and minimum maintenance, Cat lifetime lubricated rollers can't be beat.

MANY OTHER NEW FEATURES THAT EXTEND TRACK ROLLER LIFE

RIMS — made from forged steel. Deep-hardened for long life. Wide flanges resist rollover. Rims are securely mounted on heat-treated steel hub, giving superior resistance to bellmouthing.

BEARINGS have high load carrying capacity.



LARGE DIAMETER SHAFT is double heat treated, making it extra stiff and resistant to wear.

BUSHINGS contain large oil reservoirs for more lubricant and better cooling.

Easy installation is achieved by use of snap rings to hold the seals and end collars in position before mounting. End collar bolt holes will line up easily with track roller frame holes during installation.

Stop track roller greasing now with these lifetime lubricated rollers. See your Caterpillar Dealer. He will give you the complete story on this time-saving, money-saving undercarriage component.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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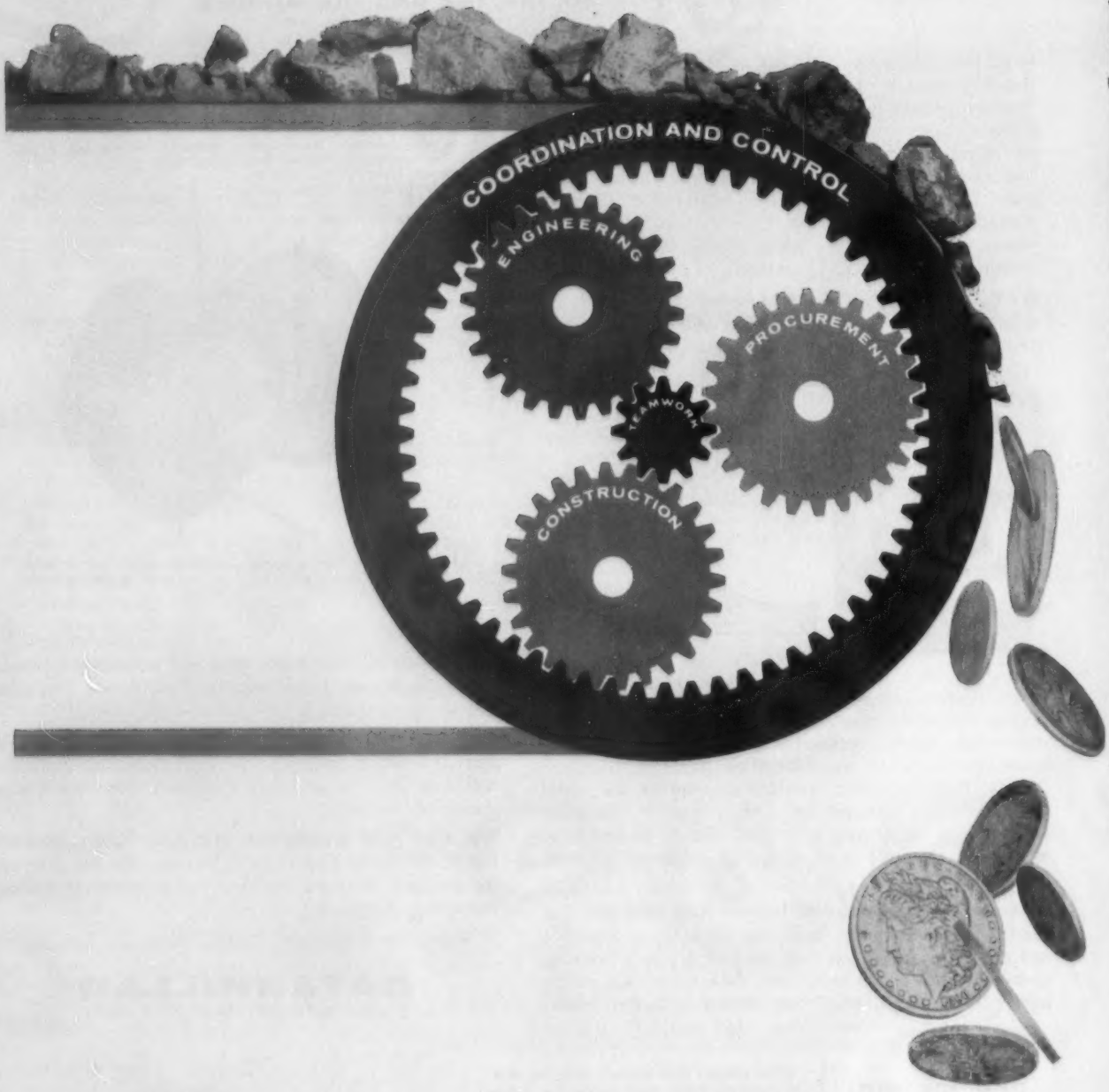
SERVICE TIP: When rebuild time finally comes, be sure to keep the metal rings matched in original pairs, being careful not to nick or mar the lapped faces.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In procurement, Kellogg criteria extend far beyond buying at the best price. To provide greater value in plant, to advance the day production can begin, every procurement activity is coordinated with engineering and construction needs. Encompassing purchasing, inspection, expediting, and traffic, Kellogg procurement is geared to the top management goals of providing the most plant per dollar.

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The revolutionary Kellogg way of doing business, well-established in other industries, is bound to have a profound effect on big mining projects. Why not let Kellogg engineers explore with you the ways in which they could best serve *your* interests? As a preliminary step, send for brochure—"Planning the New Plant for Profits".

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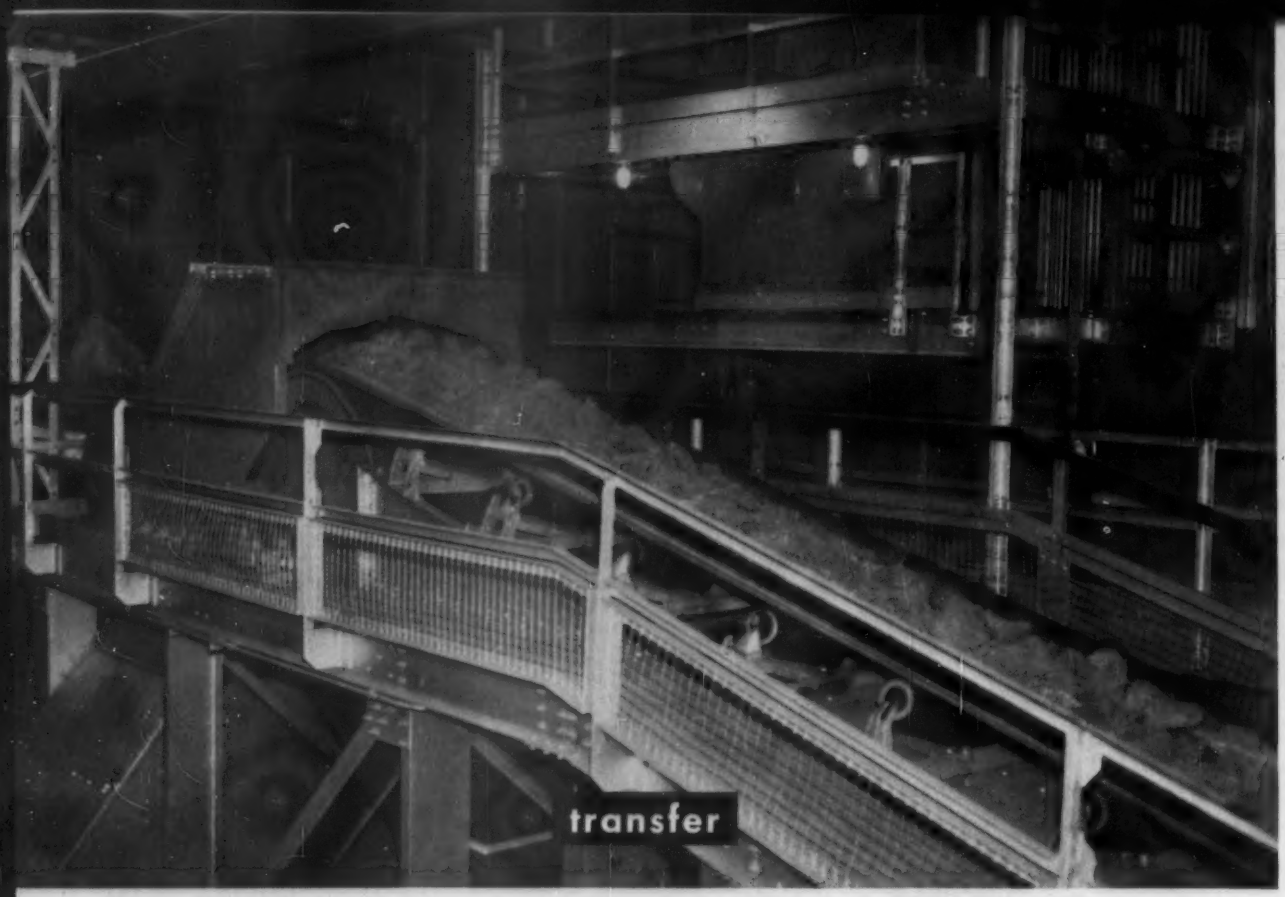
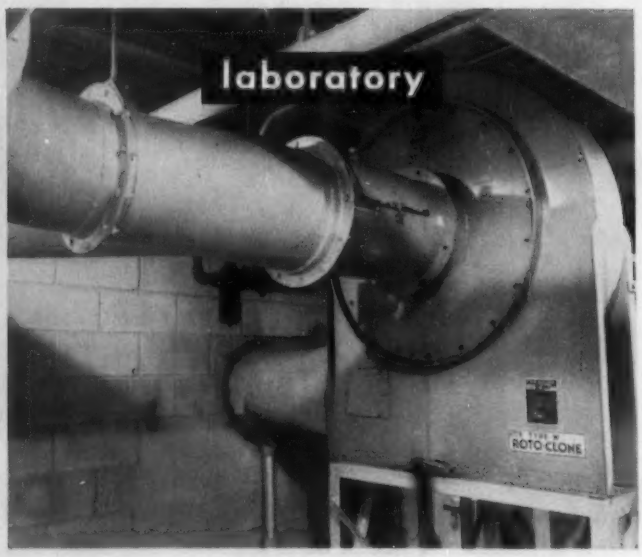
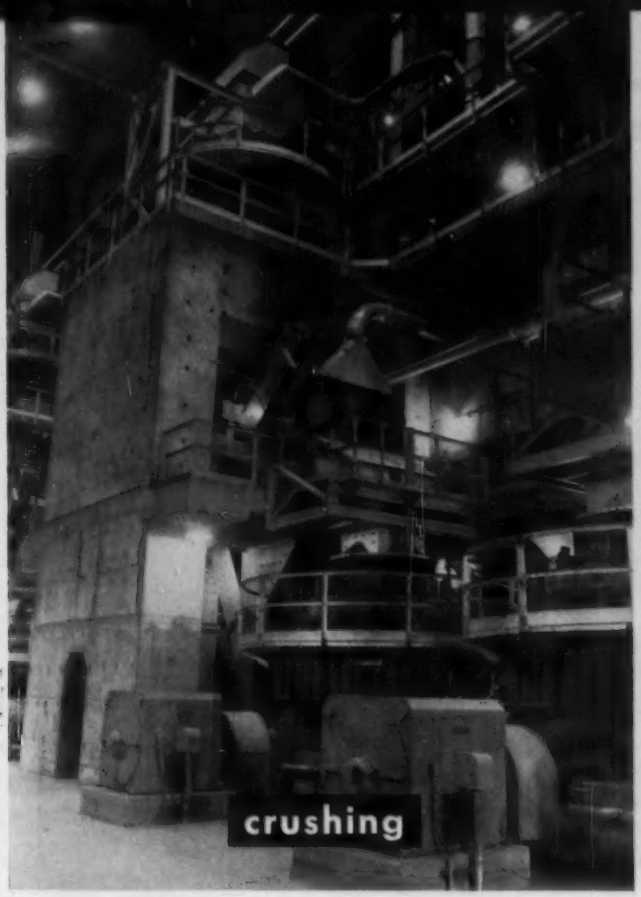


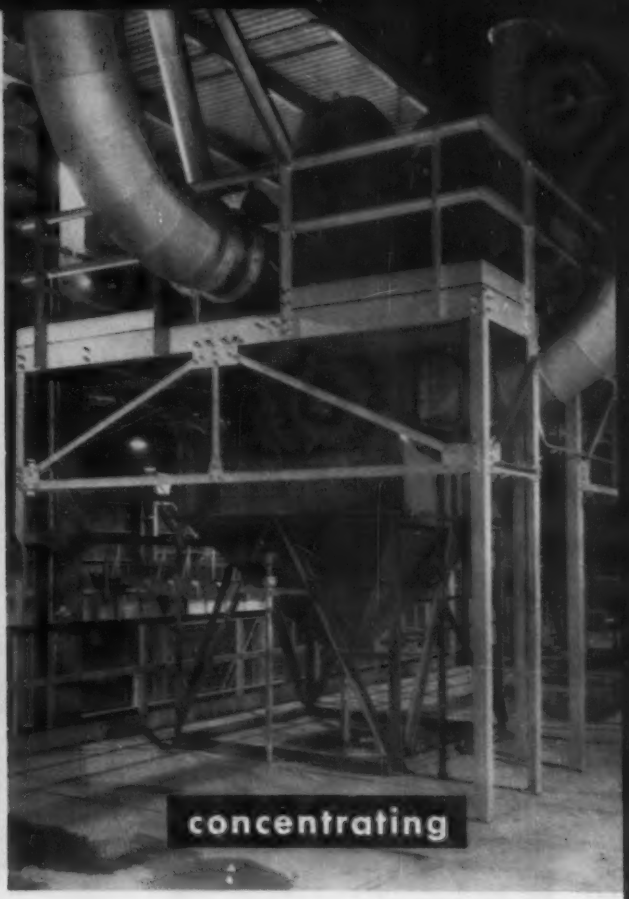
AAF dust control "rides herd"

AAF Type N ROTO-CLONE exhausting bottom discharge of pelletizing furnace. It's one of 35 Type N's at this installation exhausting pelletizing furnaces, cool dryer and transfer points.



Type W ROTO-CLONE exhausting dust-producing operations in laboratory. It's one of 30 Type W units at this plant. Others exhaust crushing, screening, transfer and bin ventilation operations.





on tough taconite ore!

All operations dust-proofed by 65 AAF ROTO-CLONES (1,100,000 cfm!)

Dust never shows its face in this modern taconite processing plant. From the first transfer point, through crushing, concentrating and pelletizing, it's under the complete control of two types of rugged AAF ROTO-CLONES—the Type W and Type N.

These collectors have been dust-proofing taconite since 1947, and are now used by *all* major processors. The Type W combines the principle of dynamic precipitation with dust-trapping water sprays. The Type N combines centrifugal force with the thorough intermixing of water and dust-laden air. *Both* offer (1) small space requirements, (2) maintained performance, (3) constant exhaust volume, and (4) high collection efficiency.

For more information on these wet-collecting ROTO-CLONES, call your nearest AAF representative or write for Type W Bulletin 274 and Type N Bulletin 277. Address: Mr. Robert Moore, American Air Filter Company, Inc., 193 Central Ave., Louisville, Kentucky.

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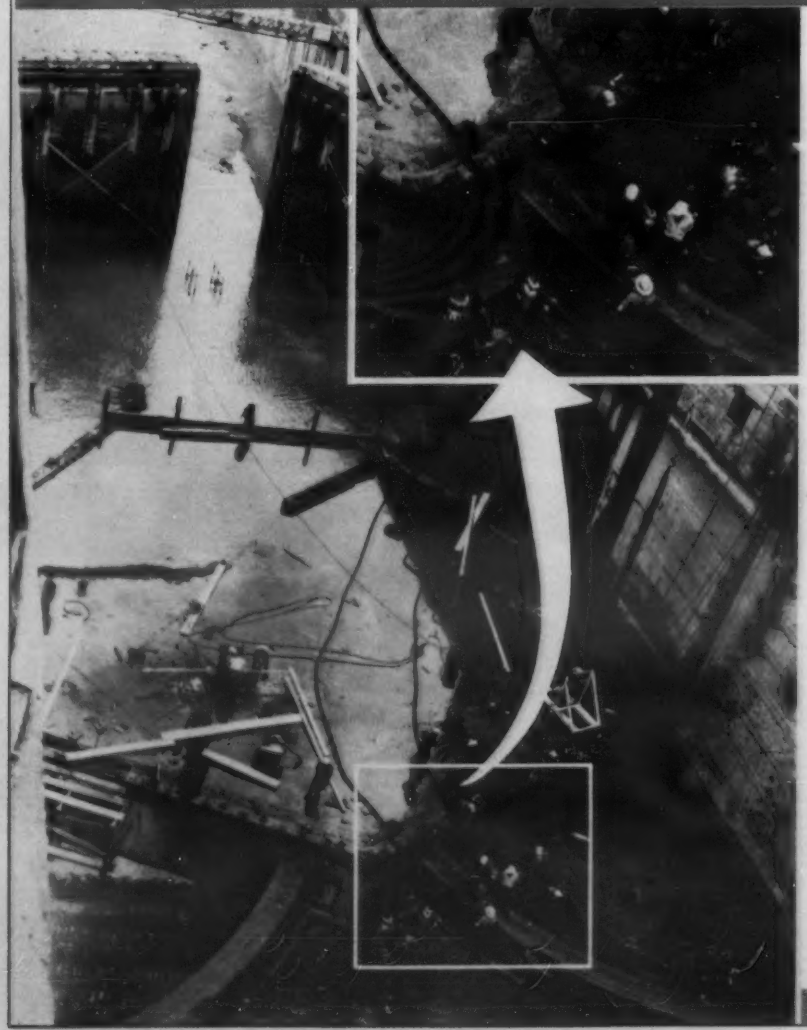
FLYGT PUMPS SPEED SEAWAY EMERGENCY JOB



Just five days before President Eisenhower and Queen Elizabeth were due to dedicate the greatest engineering achievement of the decade, a broken timber sill blocked Lock No. 4 in the Welland Canal, vital link in the St. Lawrence Seaway. Sixty-seven vessels were waiting to get through. Lock No. 4 had to be pumped out at once so that repairs could be made. Nine FLYGT pumps were rushed to the site. Only one hour after they were placed in the lock their work was done.

FLYGT pumps require no elaborate installation — they are simply lowered into the water and switched on. These electrically powered, fully submersible pumps can run for weeks without supervision. They will handle a high proportion of solids without clogging, are not damaged by salt water and do not overheat if run dry.

FLYGT pumps are available with capacities up to 3000 GPM and for heads up to 220 ft.

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Introducing

The New Earth-Mover Rim

for today's heavier loads
and tomorrow's
new equipment

To meet the increased tonnages and the higher speeds of today's and tomorrow's earth-moving equipment, Goodyear presents a whole new line of heavier, stronger rims.

The new Earth-Mover Rim offers these standout advantages in every size from the smallest to the largest:

Extra thickness and weight to withstand greater horsepower, greater tire pressure and heavier loads. Down time reduced to a minimum.

Heavy-duty bead seat band driver—to prevent slipping.

Sealing ring—Goodyear's famous Tru-Seal principle provides positive air seal.

The Goodyear Earth-Mover Rim is now available in 29-inch and 33-inch diameters. These fine job-fitted rims are your best insurance against premature tire and rim failure.

Next time you need rims, why not benefit by Goodyear's incomparable experience in building rims of every kind and size for all types of vehicles. See your local distributor, or write:

Goodyear, Metal Products Division, Akron 16, Ohio.

Your tires go farther on RIMS by

GOODYEAR

MORE TONS ARE CARRIED ON GOODYEAR RIMS THAN ON ANY OTHER KIND

CATERPILLAR'S **No. 1** PROJECT

PAYS OFF FOR YOU AGAIN

Giant Series

New power! New design! New features! Plus a new drive option—Cat power shift transmission! The result: higher production on any application!

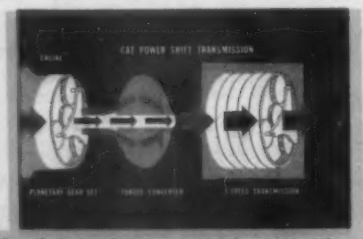
Now the "King of the Crawlers" is better than ever with new pace-setting capacity for higher, faster, lower-cost production on *any* big tractor application!

The biggest "new look" in the giant D9 Series E is the undercarriage. It's more massive . . . more rugged than ever. It'll add hours of life to running gear on even the toughest jobs. *Every* track component is new in design, highlighted by a big, new link—its pitch is increased 1¼" to 10¼"! And a new Caterpillar-developed steel alloy strengthens links, shoes, rollers *up to 40%!*

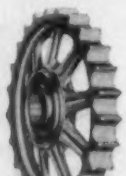
That's not all: the new D9 packs more power—335 HP. Its new equalizer bar gives greater stability on any terrain for greater operator confidence and production. A wider seat with a new spring-loaded adjustment mechanism makes the operator more comfortable, more efficient. No detail has been overlooked to make the new D9 handle heavier loads faster—and at lower operating and maintenance costs than ever.

And that's not all. Now, along with direct drive and torque converter, you have your choice of the new Cat

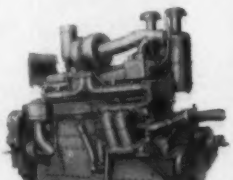
Dry-type air cleaner. Removes at least 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes. Reduces maintenance time and cost.



Exclusive feature. A planetary gear set splits the power from the engine. Part goes directly to the 3-speed transmission, the rest goes through a torque converter to transmission.



New sprocket. Sprocket is strengthened by new design with increased tooth thickness. Hunting tooth action provides slower wear rate.



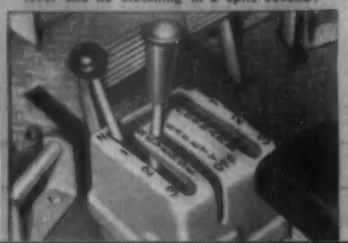
New 335 HP. More powerful than ever, the D9's Turbocharged Engine has the capacity to handle bigger loads faster, with dependability, economy.

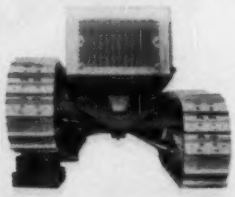
New Turbocharger. New, compact turbocharger packs more air into the engine. Open impeller wheel (shown below) helps prevent dirt build-up.

New power shift transmission. Optional on the D9. With this development you can shift on-the-go under full load with one lever and no clutching in a split second!

New, bigger, more rugged undercarriage. Major improvements in all track components add hundreds of hours of life to running gear—hours that mean more time on the job.

New equalizer bar. Greater stability. The rocking action of the bar shifts more weight to the up-hill track.





new CAT D9 E Tractor

power shift transmission. This revolutionary transmission, tested under the most rugged conditions, combines for the *first* time the positive feel of direct drive with the flexibility and anti-stall features of torque converter. With one control lever and no clutching, it reverses direction . . . changes speed . . . smoothly . . . under full load . . . in a split second!

Many of the new features, along with some familiar retained features, are shown here. Look them over. They'll give you an idea *why* the new D9 can mean higher production and more profits for you. For complete facts, see your Caterpillar Dealer. Ask for a demonstration and watch this giant eat up the work!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR'S **No. 1** PROJECT

CATERPILLAR'S NUMBER ONE PROJECT A multimillion-dollar research and development program — to meet the continuing challenge of the greatest construction era in history with the most productive earthmoving machines ever developed.

CATERPILLAR

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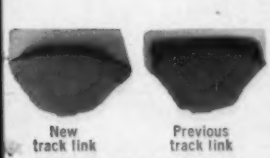
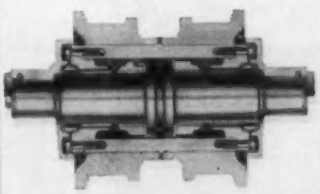
NEW D9 SERIES E— BORN OF RESEARCH PROVED IN THE FIELD



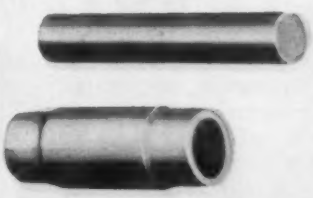
New track link — Previous track link

Light area at top indicates depth of hardening

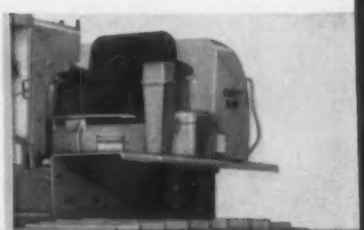
New deep hardening steel. Caterpillar-developed steel alloy (plus more steel in stress areas) gives up to 40% longer life to track shoes, links and rollers.



Lifetime lubricated track rollers. Lifetime lubrication eliminates servicing problems. Oil is retained by dirt-proof, floating-ring seals.



Larger pins and bushings. Diameters are ¼" larger. Increased size reduces deflection and provides better contact along the length of the wear surfaces.

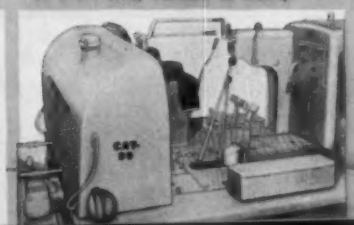


New seat adjustment. New spring-loaded adjustment mechanism provides more positive cushion and back rest positioning. Wider seat for more comfort.

Better visibility. Redesigned fuel tank gives better visibility to the rear and tapered hood offers unexcelled forward vision.

Stronger track shoes. New alloy permits deeper hardening in wear areas. Grouser height is increased ⅜" for better penetration and prolonged service life.

New foot decelerator. Provides easier machine positioning. Allows deceleration without taking hands from controls (optional on direct drive, standard on others).

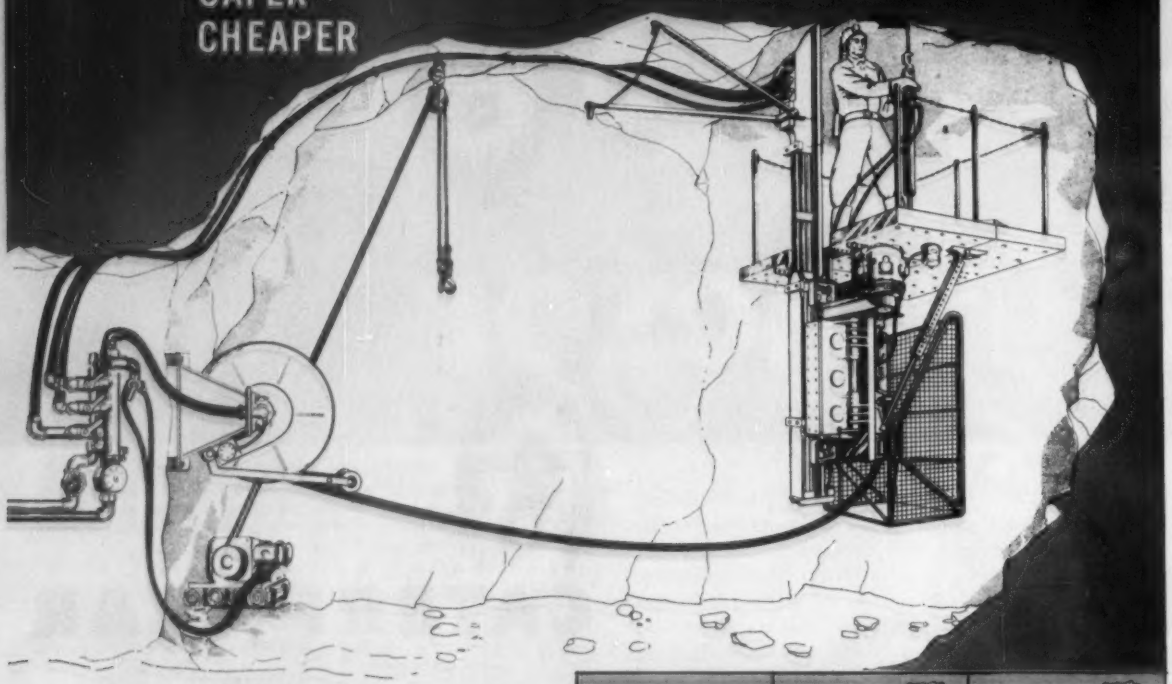


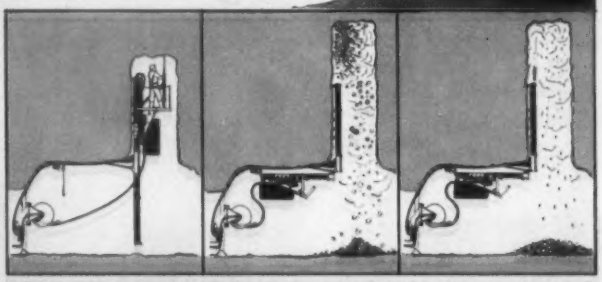
Bigger, heavier track links. Strength has been added in stress areas. Pitch increase from 9" to 10¼" strengthens all track components.

NEW ALIMAK Raise-Climber*

Provides fully self-contained elevating system for driving raises from 40 ft. up to 1200 ft. or more

FASTER
SAFER
CHEAPER





Climber moves up guide rail, fastened to rock by expansion bolts. Permits full range of operations at face of raise.

Bottom guide rails and *Climber* swing back under cover of the roof for blasting. *Raise-Climber* method eliminates staging and restaging.

High-pressure water and air provide quick clean-out of gases and dust; assures faster drill-blast cycle in verticle or diagonal raises.

This major advance in driving raises is not only faster in all types of rock, but eliminates much of the heaviest and most dangerous work associated with existing methods. The *Alimak Raise Climber* consists of an easily portable all steel elevator which quickly climbs a rack equipped guide rail. The operator is raised to the working face where he drills for charges. After descending, the platform is folded back for blasting, cleaning out and ventilating. Operator then ascends and fits another 3 ft. or 6 ft. rail section for the next drill-blast cycle.

One man can carry out all operations with fingertip control of four services housed in rail section — air, water, electricity and telephone.

Thoroughly tested and proved in over 60 worldwide mining operations, the *Alimak Raise Climber* holds the *Mining World/World Mining Magazine* 1959 *Blue Ribbon Mining Award*.

Complete sales and service representation available throughout the United States. Write for full details, today.

*Patent Pending

A Product of Swedish Engineering

ALIMAK®
RAISE-CLIMBER ELEVATING SYSTEM
Alimak Corporation
306 Avila St., San Francisco 23, California
A Subsidiary of Alimak-Verken AB
Skelleftea, Sweden

Now—more light, less weight, longer life with

NEW EDISON MODEL S ELECTRIC CAP LAMP

MSA announces another new *high* in lighting efficiency in the world's most popular cap lamp. Increased light output of the new Edison Model S Lamp assures greater safety for the miner, more tons per shift for the operator. Let's face a fact: Dimness costs money. *Fair* lighting does only a *fair* job. Maximum lighting—the brilliant, unfailing Edison Model S kind—helps get jobs done with top speed and safety. And the simplified method of charging new Model S Batteries—with the AUTOMATIC LOW-VOLTAGE SYSTEM—is convenient, thrifty and highly efficient. Lets miners take their lamps and rack them—quickly—without loss of time or waste motion. When planning a new lamphouse installation or modernizing your present one, call in the MSA Representative. MSA can help you solve your lighting problems.

Newly issued U.S. Bureau of Mines Approval 6D-31, April 16, 1959.

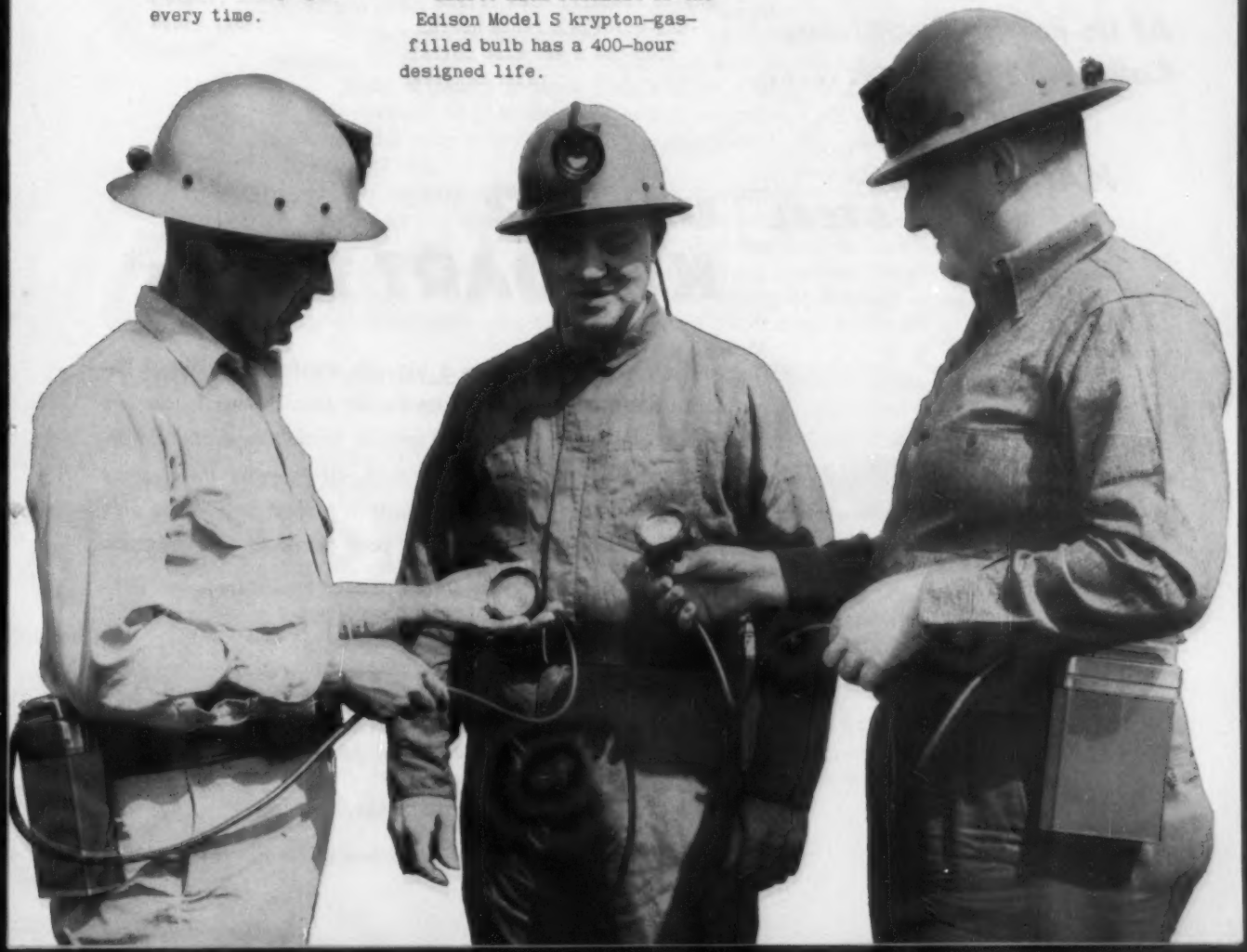
MSA
SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY • 201 North Braddock Avenue, Pittsburgh 8, Pennsylvania
MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED • Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg
MINE SAFETY APPLIANCES CO. de MEXICO, S.A. de C.V. • Mexico 4, D.F., Mexico

Look how small the headpiece is. Weighs only a few ounces. Feels even lighter on the head. You get a clear, sharp spot every time.

Increase in working light appeals to me. This new Edison Model S gives 15% more than we ever had before. And they didn't cut their bulb service life rating to do it. The double filament bulb means we'll always have working light to finish the shift. Each filament of the Edison Model S krypton-gas-filled bulb has a 400-hour designed life.

Just watch the improvement in our safety and tonnage reports. More light. Less weight. Longer life. Even the battery's better. It has a new active material that boosts service life. They went all-out to meet the miner's needs with this one.



At its Eagle Mountain, California open pit.....

KAISER STEEL uses 12 KW-DART Trucks*

*11 are 803B
1 is 804B

And all twelve are doing a big job satisfactorily. Why? Because KW-Dart's 803B Tractor-Trailer Rear Dump Trucks are custom-engineered for each specific mining operation. KW-Dart has been building heavy-duty, off-highway trucks since 1903 and will combine components in perfect balance to give you the most efficient truck for your particular requirement.

Call for a KW-Dart engineer to discuss your haulage problems.

KW-DART TRUCK CO.

Subsidiary of Pacific Car and Foundry Company

1301 North Manchester Trafficway
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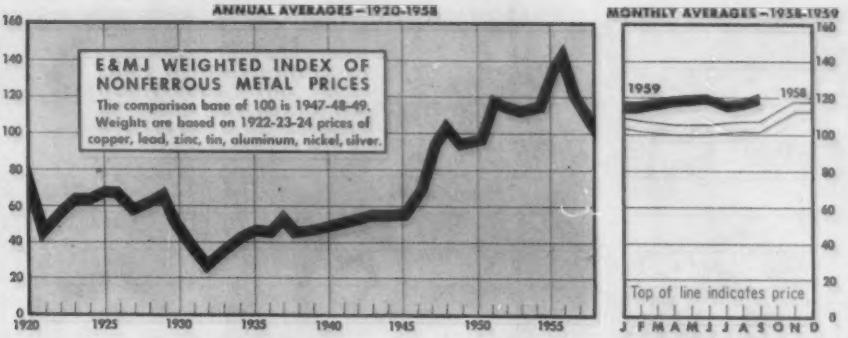
E&MJ OUTLOOK

PRICES



MARKETS

Substantially higher prices for copper, lead and zinc accounted for the increase in E&MJ's metal price index from 119.0 for August to 122.5 for September.

Metal research departments and manufacturers are working toward the commercial production of refrigerating and heating-cooling devices which will use the Peltier effect (the absorption or production of heat when electric current is passed in varying directions through a bi-metal.) Bismuth and tellurium are regarded as most promising metals; but selenium, arsenic and gallium are also being considered.

•

AT HOME

Ore docks at lower lake ports are comfortably filled with iron ore because producers had adequate warning before the steel strike to step up shipments. Little additional ore will be required to fill requirements for winter stockpiles.

U. S. uranium procurement for fiscal 1959 will total about 33,330 tons, including 15,160 tons from domestic sources, and 18,170 from foreign sources.

Webb & Knapp Strategic Corp.'s plans to install a $15-million plant to produce steel and other by-products from the copper slag pile at Clarkdale, Ariz., has aroused a surge of interest and some skepticism in New York mining circles. See story, p 130.

The domestic iron and steel industry is under intense pressure to cut costs in order to meet competition from foreign steelmakers and other metals, according to Max Howell, vice president of the American Iron & Steel Institute.

Texstar Minerals Corp., San Antonio, Texas, has been formed to develop and improve processes to recover values from tailings or in placer deposits. The company owns 6,000 acres of land containing placer deposits and mining dumps.

•

LABOR

The National Right to Work movement, with headquarters in Washington, D. C., is gaining momentum. A recent tract reports that the average hourly increase in earning in right-to-work states for 1953-1958 was 24.7%. In states not having right-to-work laws, the increase was 21.3%. Nineteen states now have right-to-work laws.

•

ABROAD

Reserves of U_3O_8 were reported in tons as follows by S. Bowie, chief geologist, Atomic Energy Division, Geological Survey of Great Britain: Canada, 413,000; Union of South Africa, 330,000; U.S., 221,000; France, 50,000; Australia, 15,000; Belgian Congo, 10,000. Thorium reserves (ThO_2) were reported in tons as follows: India, 300,000; Canada, 210,000; Brazil, 200,000; Australia, 50,000 U.S., 50,000; South Africa, 15,000; West Africa, 15,000; Nyasaland, 10,000.

Kaiser Aluminum has accepted Ghana's invitation to form an international group to build an aluminum smelter near the Kosombo and Volta rivers.

A Japanese company will build a $2.8-million nickel smelting and refining plant at Bindura, Southern Rhodesia.

THIS MONTH IN MINING

CHARLES SCHWAB, of the Emergency Lead-Zinc Committee, cautioned some nonferrous smelter firms.

JESSE E. JOHNSON, director of Raw Materials for AEC, discussed hazards of radiation to uranium men.

CLARK L. WILSON, New Park Mining, was elected chairman of the western governors advisory council.

Technology and Tariffs Dominate AMC at Denver

THE VITALITY of domestic mining men as they approached the problems of technology, tariffs, quotas and mineral production was discernable everywhere at Denver last month at the meeting of American Mining Congress.

The technical subjects ranged from estimating costs through shaft sinking, personnel selection, milling and mining to radiation hazards. On these and subsequent pages the highlights are summarized.

In the political and trade areas, representatives from industry, Congress and Government tackled and battled the subjects of the current lead-zinc quota system, a suggestion for tariff relief by some smelting firms, and the almost total demise of the strategic minerals industry. Congress adjourned last month without accomplishing much of the industry's wishes, but there were some compensating thoughts offered at the convention. (See p 20, this issue.)

Sen. James E. Murray (D.-Mont.) while expressing disappointment at the Administration's failure to put forth a national minerals policy, failure even to show enthusiasm for the project, did offer some consolation and cause for optimism. Foreign competition was hurting other industries than mining, he said, and the industry could soon expect to receive help in its fight for a strong domestic production.

Industry leaders have long known that one of the major obstacles to a national minerals policy is the lack of unity on the part of industry itself. Charles E. Schwab, chairman of the Emergency Lead-Zinc Committee, lauded the proposal by some smelters that some tariff be imposed, but also warned that the producers would remain cautious.

"We in the domestic mining industry willingly acknowledge the change in attitude (as) a very significant event, and we compliment those who have seen fit to make this announcement. But let me suggest caution should you optimistically predict that the lead-zinc miners and the lead-zinc importing smelters will now find common ground for presentation to the Tariff Commission next January."

He noted that both the smelters and miners would make a sincere effort to resolve differences in their forthcoming talks, but added, "Let me make it crystal clear that after all the domestic lead-zinc mining industry has gone through, we will not bargain or negotiate in any game of musical chairs which would rescind the present quota plan . . . and substitute an inadequate tariff or import schedule." He added: "I do not think it is too much to ask for some self-discipline on the part of U.S. smelters with the end result of improving the lot of the miner."

Another difficult, but perhaps potentially more valuable road to solution was offered by David C. Minton, vice president of Battelle Memorial Institute, who said, "I merely wish to state that it is dangerous to put all your eggs in one basket—to look to political action for the ultimate solution of minerals problems." Noting that the world trend was toward freer trade, he advocated more attention to cost reduction, utilizaton of new by-products, diversification and integration, and new uses of metals.

Summaries of other speeches follow. For further information on the political and economic aspects, see Washington Impact, p 20 and Markets, p 22, this issue.

In his speech, Senator Murray called for the following formulas:

"Nationwide recognition, at all levels and in all branches of government, that we must be as nearly self sufficient in minerals as possible. That in respect to those minerals of which the U.S. produces 40% or more of consumptive need, import quotas be imposed at a level guaranteeing domestic producers of each mineral at least as to their maximum historic share of the American market, plus a proportionate share of future domestic consumption increases. That materials contained in the Government stockpile may be released only with Congressional consent and then over a long period of time . . . with consultation of industry.

Wilson Elected

Clark L. Wilson, vice president of the New Park Mining Co., Salt Lake City, has been elected chairman of the western governors minerals advisory council, succeeding S. H. Williston, vice president of Cordero Mining Co., Palo Alto, Calif.

W. G. Maloney, consultant for the Mining Association of Montana, was named vice chairman. Secretary is Frank A. Knight of the Arizona Department of Resources.

The council represents 13 western states, makes recommendations to governors of those states regarding national mineral policy.

The grass-roots mining organization met with governors and their representatives at Sun Valley, Ida. Sept. 24-26 to iron out recommendations to be presented to the Administration and the next session of Congress relative to minerals affairs.

Skip Hoisting at Nevada Mines

Advantages of the new 25-ton capacity skip hoist at Nevada Mines Division of Kennecott Copper Corp. were listed as follows by Frank Quilici, pit superintendent:

1. Greatly reduced stripping ratio required for pit expansion over conventional haulage methods in that limited

access and service roads are required in reaching ultimate pit limits.

2. Elimination of the necessity of maintaining benches for railroad tracks or haulage roads.

3. Flexibility in planning the mining sequence.

4. Lower pit capital and maintenance costs.

5. Minimizing ore car maintenance on the mine-reduction plant rail haul due to decreased loading damage as well as an improved load factor.

6. Increased productivity.

Maximum capacity of the skip hoist is 1120 wet tons per hr. Total hoisting distance is 1,215 ft. Total vertical rise is 405 ft.

Mining Costs

Discussing "Mine Development and Mine Operating Costs," John W. Chandler, American Metal Climax, Inc., noted the increase in costs of room and pillar mining by comparing the 1927-1929 costs with those for 1955-1959.

Costs of labor per ton were $0.648, other costs per ton $0.381, and total costs per ton, $1.029 for the 1927-1929 period. These increased to $0.895, $1.142 and $2.046 per ton, respectively, for the 1955-1959 period. During the

(Continued on p 162)

Mining Calendar

AIME-ASME Joint Solid Fuels Conference, Netherland-Hilton Hotel, Cincinnati, Oct. 27-29

ASME Metals Exposition and Congress, Chicago, Ill. Nov. 2-6

Fifth Symposium on Mining Research, Missouri School of Mines, Nov. 19-20

17th Annual Electric Furnace Conference, Cleveland, Ohio. Dec. 2-4

Annual meeting, AIME, New York, Feb. 14-18, 1960

Australasian Institute of Mining & Metallurgy, Adelaide Branch Symposium on Hydrometallurgy, "Wet Processing," of Minerals and Industrial Products," Feb. 16-19

Governor's Industrial Safety Conference, statewide meeting, San Francisco, Calif. Feb. 16-17

Symposium on Pilot Plants in Metallurgical Research and Development, Jamshedpur, India, February

Fifth International Mineral Processing Congress, Westminster, London. The Secretary, Institution of Mining & Metallurgy, 44 Portland Place, London, W.1, England. April 6-9

International Congress on Research into Ground Control and Rock Mechanics, Paris, France. May 16-20

Wyoming Mining Association, Jackson Lake Lodge, Wyo. June 10-11

XXI International Geological Congress, University of Copenhagen, Denmark. American Geological Institute, 2101 Constitution Avenue, N. W., Washington 25, D.C. Aug. 15-25

(This Month continues on p 128)

As We Went to Press . . .

Tension in the Caribbean intensified as Premier Fidel Castro announced an industrialization plan for his island nation and said the nickel and cobalt concession granted Moa Bay Mining Co. "by the Batista administration" would be "reconsidered." He also said that the National Bank of Cuba might bid for the U.S. Government-owned Nicaro plant, now up for sale.

Richard V. Colligan, president of Moa Bay, a subsidiary of Freeport Sulphur Co., said his company had received no concessions from the Batista government.

Colligan noted that the mineral rights involved "were originally granted more than 50 years ago in strict conformance with the laws of Cuba," and that Freeport had acquired an interest in them 19 years ago. (This was prior to the rule of the overthrown Batista, who fled Cuba with the success of the Castro revolution last year.)

The mining company president also noted that Moa Bay's partial tax exemptions were much lower than those granted other enterprises, and that in relatively few years the project "will take its place as one of Cuba's largest taxpayers." (See news story, p. 150.)

U.S. Glass & Chemical Corp. will construct a $500,000 mill near Dierks, Ark. to produce barite. Construction of the 35,000 tpy plant will be by O. W. Walvoord, of Denver, with completion due in about seven months. Robert B. McElwaine, consultant, will direct the new barite division, which will obtain its ore from open pits in the area, owned by the company.

High purity tungsten—four-nine grade—is being "captured from a mixture of gases and simultaneously formed into simple shapes" by USBM metallurgists. Director Marling J. Ankeny said the process has produced small quantities of 99.99% metal at the Rolla, Mo. research center, and might open possibilities of plating tungsten on many surfaces.

At Reno, the Bureau has developed a fused-salt electrolytic process which simultaneously produced 98% pure molybdenum powder and a tungsten powder of better than 99% W.

Ivor G. Pickering, who joined the staff at Bingham in 1939, has been named general manager of the new $30-million Kennecott Refining Co. refinery at Baltimore, Md. by C. D. Michaelson, general manager of the Western Mining Division of KCC.

Canada's first direct reduction steel plant will be built by Premium Iron Ores, a Cyrus Eaton property and sales agent for Steep Rock Iron Mines. The plant, according to P. E. Cavanaugh, vice president, will use the HyL Process engineered by Canadian Kellogg Co., and will be constructed at Williams-Port Arthur. (E&MJ, October 1958, p 150)

Premium will produce 150,000 tpy at the $10-million facility, using Steep Rock ore and Alberta natural gas. (Also see the St. Lawrence area story, August 1959.)

Delhi-Taylor Oil Co. is drilling near the foot of Dead Horse Point, southwest of Moab, Utah at the site of the famous Shafer Dome. The company has a number of potash permits for the area, which was the scene in 1938 of a publicized oil bubble.

WASHINGTON IMPACT

Highlights

CONGRESSIONAL RECORD—At the Denver, Colo., annual meeting of the American Mining Congress last month, the attention of domestic metal-mineral industries was focused more than ever on Washington.

That keynote is simply the same question that has been foremost in Washington since the end of the boom in 1956: What can the Administration and Congress do to support a strong domestic mining economy?

This year, as in the past three, the answer to that question as far as Congressional action is concerned is mixed. Certainly domestic metal-mineral producers cannot claim anything close to their goals. On the other hand, the record of this session of Congress gave U.S. mines more than they might have anticipated, plus some distinct hopes for next year.

TWO VICTORIES—specifically, the so-called mining "bloc" in Congress won two precedent-setting victories this year.

One was the Senate directive to the Tariff Commission to re-open for a third time the question of import protection for domestic producers of lead and zinc. Another Commission study in itself does not hold any significant promise. But this time, for the first time in the Commission's history, it was directed to take a specific stand on the question of additional import controls—something it never before has been asked to do in a general investigation of this kind.

The Commission traditionally has favored more domestic protection than the White House has seen fit to grant. Odds are that it will again recommend stronger curbs on foreign shipments—either by extending existing quotas to manufactured and semi-finished products, by tightening existing quotas, or by raising import duties.

Mining-state legislators count on next year's election climate to underscore the Commission's predilection toward heavier restrictions on competing imports. Yet opponents, too—led by six large domestic smelters who recently protested current import quotas—welcome the "breathing spell." They hope, as predicted by Interior Department and other Administration spokesmen, that by next spring when the Commission reports, current quotas will appear to have done a better job.

MINING POLICY—The other mining industry victory on Capitol Hill this session was the endorsement by both houses of Congress given Rep. Wayne Aspinall's (D-Colo.) House concurrent resolution (#177) which called on the White House to review existing domestic mining policies with an eye toward making them more effective.

While not a bill, it is the first formal and final expression of what lawyers call "The Sense of Congress" that the Administration should come up with some sort of over-all mining policy. Further, and perhaps more important, implied in passage of the Aspinall resolution is the charge that present programs are not adequate to maintain a sound domestic metal-mineral economy.

It will be difficult, if not impossible, for the executive branch to totally ignore this expression of Congressional sentiment.

SO WHAT?—Any realistic evaluation or assessment of even these two victories must of course take into consideration other policy factors—monetary, foreign, and so on—which now are working against the goals of many domestic metal-mineral producers.

So the big question is still hanging fire: What will the Administration do? Part of the answer is clear. Incentive purchase programs are dead—Sen. James Murray's (D-Mont.) unsuccessful attempt to revive the domestic manganese carlot purchase program is a case in point.

It is also clear, in Washington and Denver, that the Office of Civil and Defense Mobilization intends to actively seek, from Congress, broader authority to unload nearly half of its $8-billion national stockpile.

The main remaining issue is trade and import restrictions. The stated foreign economic policy of this Administration favors freer trade, and even the stimulation for foreign mining ventures by both U.S. and local national private enterprise.

But the tariff commission lead-zinc directive, over White House objections, may lead to a continuation of some sort of piecemeal, case-by-case flexibility on the part of the Administration.

More than any other factor weighing against any dramatic new mining policy, however, is the simple fact that the present Administration has only another 14 months to serve in office.

Congress Goes Home; The Issues Remain

Here are the issues to watch in the coming months which will have an effect on domestic metal-mineral industries:

Stockpile Disposal — The Administration, motivated by the familiar short-war defense theory and budgetary worries, is set on loosening up procedure for selling off unwanted Government stocks of strategic supplies.

Office of Civil and Defense Mobilization director Leo A. Hoegh has told Congress, and his deputy, J. Roy Price confirmed at the American Mining Congress Meeting in Denver, that new legislation to give the Administration greater leeway in unloading excess stockpile materials is in the works. (See p18) He made one concession—largely a political one. The proposal will not be sent to Congress until the agency makes another study of defense requirements.

Price told AMC it will be submitted next year. The domestic mining bloc in the Senate will fight it. The plan is to ask Congress to let OCDM declare surplus about half the $8-billion storehouse, put it in a so-called National Materials Reserve Inventory which could be sold off without specific Congressional authorization.

Mining-state legislators' opposition to sales of surplus copper shelved a plan to sell 130-million tons earlier this year. But copper disposal will come up again if the labor strike continues — although mining spokesmen in Congress have told OCDM staffers they will go along only if an international shortage develops, and then only if the ceiling on sales is limited to about 25-million tons.

Meanwhile, OCDM's buying agency, General Services Administration, already is asking Congressional approval to unload small tonnages of a growing list of materials.

Trade Policy—This remains the hottest issue for domestic mines. The Senate got the Tariff Commission to re-open the question of stricter limits on lead and zinc imports, and even broke precedent by directing it to take a stand on the issue. A similar investigation of fluorspar imports also was ordered.

These directives give the Commission a new role in helping make trade policy decisions, even if only on a case-by-case basis.

Other trade decisions went against domestic producers. Appeals to OCDM for new import protection on grounds of national security or defense-essentiality had been virtually written off as this issue of E&MJ went to press. One for fluorspar was certain to be shelved in light of the Tariff Commission study. Decisions against similar pleas for cobalt and tungsten were frankly predicted by agency staffers.

Fluorspar producers also lost out in an attempt to win import quota relief

from Congress, when the Senate Finance Committee failed to report a bill by Sen. James Murray (D-Mont.) which would have patterned quotas after the protective Sugar Act.

But Murray himself gave the American Mining Congress a hint last month that he plans to center his continuing drive for more Federal support for domestic producers around tariff and quota import protection.

Murray talked broadly in terms of case-by-case protective devices. The first procedural step is to seek these through Administrative agencies. But Murray also talks hopefully of winning Congressional support for legislated import restrictions, something Congress has refused to do for nearly 30 years.

Murray counts, of course, on the election-year political climate next Congressional session, which will give a boost to the drive for more trade protection.

But working against that drive will be what Administration officials, and advocates of freer trade, hope is a continued business upturn which will boost domestic mining production, employment, and maintain prices.

Over-all Mining Policy—As an issue, this is the vaguest, and hardest to predict. The formalizing of an Administrative metal-minerals "policy" as such could mean much or little. The approach is favored by Interior Secretary Fred A. Seaton, who tried a similar move last year and backed Congressional efforts along similar lines this year.

The mere establishment of a minerals policy doesn't necessarily mean new support programs. But if one is given White House blessing, however vaguely worded, it would act as a basis for the Congressional mining bloc to press for more favorable executive action on its attempts to get more aid for the domestic mining industries.

GSA Offers Nicaro For Sale; Bids Due Dec. 1

GENERAL SERVICES ADMINISTRATION has once again put on the auction block its $85-million nickel plant at Nicaro, Cuba. The subject of bitter political and economic controversy, GSA has been trying to sell the facility for more than two years.

Unrest in Cuba itself seemed to kill off what slim chances the Government had of unloading the plant. Cuban investment climate for U.S. capital is even now wholly uncertain, depending on Cuban prime minister Fidel Castro's whims.

Yet GSA now feels it has indications of firm enough interest in the plant to go ahead with the sale. Officials say in fact that U.S. investment attitude toward Castro's Cuba is changing somewhat—is now more favorably inclined than even a few months ago.

The agency will accept bids on Nicaro through Dec. 1, 1959.

Labor This Month

NEW LABOR LAW TOUCHES ALL BASES: Between its anti-racketeering provisions and Taft-Hartley amendments, the new reform law reaches all unions and employers at some point. But the effects vary considerably. In some industries, union organizing could be slowed almost to a halt. In others, the new rules will hardly matter. Take the new curbs on secondary boycotts and picketing. These will be felt mostly among smaller employers, such as trucking, retail, gas station operations. Unions have frequently used pressure devices against employers to organize their workers, by picketing a plant or store or by pressuring other employers not to do business with the target employer. Both these practices are now banned.

REFORM LIMITS—BIG STEEL-MINING: In the big, fully-organized industries, unions such as the United Steelworkers and Mine-Mill and Smelter Workers won't feel much of the new Taft-Hartley pinch. The tactics banned under the new law aren't usual practices of industrial unions. Their big business—bargaining and/or striking—in a major industry—isn't touched under the 1959 reform bill. And, in fact, there's one significant change in the new law that could help the bigger unions. The law permits strikers to vote in representation elections within a year after the strike starts. This means the union is less likely to be voted out where an employer puts replacements in the job. Under the old provision, only the replacements could vote on whether to keep the union.

REFORM POLICEMEN—WELL ARMED: With the new law come some weapons for enforcement. The Taft-Hartley rules changes all go before the National Labor Relations Board, first through its new general counsel, Stuart Rothman. He decides whether the new rules are being broken, after an employer or union makes a protest. If he carries an unfair labor practice charge to the five-man Board, it gets automatic priority over pending cases.

Policeman No. 2 is Labor Secretary James P. Mitchell, who receives and controls all reports required of employers and unions. The power of the Labor Secretary is strong; he can investigate reports on his own initiative, subpoena witnesses and even compel testimony by granting immunity to the witness. The penalty for employers and union officials is a maximum $1,000 fine and one year in jail.

REFORM REPORTS COMING UP: The new anti-racket rules applying both to unions and employers are soon to become effective. Under the new law special reports are required on the financial and Administrative practices of management and labor officials. But the effective dates of such reports, as well as the new Taft-Hartley rules, are staggered. They come out this way:

- Employer reporting—90 days plus: The new rules require every employer to report on loans, expenditures or payments made to union officials or members affecting their right to organize and bargain. Such details must be filed within 90 days after the end of the company's fiscal year. Reports are also required on payments made to "middlemen" who serve as agents in an attempt to affect the right of union members to organize or resist unions. The middleman, on the other hand, must file payments received in this connection within 30 days of the payments received.

- Union Reporting—90 days even: More extensive details must be revealed by union organizations and their officers. Unions, from the moment President Eisenhower signed the law, have 90 days to give full fiscal details—including officers salaries, loans to officers or members or business organizations, etc. Officers themselves must provide information on all financial interests, including any business arrangements that might involve conflict of interest.

- Picketing and boycott curbs—60 days: This is the grace period allowed under the new rules before the unions must drop such activities. At the point 60 days from the reform bill signing, employers can take legal action against organizational picketing where it doesn't fit the legal limitations. And they can then resist union secondary boycott pressures with the backing of the NLRB.

MARKETS

Copper Prices Higher in the U.S.; Aluminum Sales Down; Zinc Prices Up

NON-FERROUS METAL PRICES, measured by the E&MJ index, moved up in September to 122.5% of the 1947-'49 average from 119 in August. The rise was the result of the increase in copper to 31.018c from 29.893c and of lead to 13c from 12.286c.

Some copper prices were raised in the U.S. as a possible copper shortage threatened. White Pine (Copper Range) raised to 31½c from 30 c, delivered in the U.S., effective September 9. Most other producers followed. Anaconda announced on that date that future deliveries of copper in the U.S. of foreign origin would be priced at 31½c; this includes the import duty of 1.7c a lb. It later announced that its sales of copper for the account of Inspiration Consolidated Copper Co. would be at the 31½c price.

Phelps Dodge reported that it had no copper to sell and that therefore it was not quoting a copper price. Kennecott maintained the 30c price; as of October 6 it was still at 30c. Its fabricating subsidiary, Chase, also stayed with the 30c pricing basis. Its newly acquired subsidiary, Okonite, raised to the 31½c basis presumably because some of its copper is purchased from firms that had raised to 31½c.

Strikes had eliminated most custom smelter selling of copper. American Metal Climax had settled with Mine-Mill and established a 33c delivered price.

Merchants had started the month at about 33½c; their prices fluctuated from about 33¼c to 34c and possibly some for delivery well inland 34¼c. They ended the month at about 34—34¼c.

One large U.S. producer whose mines and smelters have been struck has continued to deliver copper in good quantity, mostly from warehouse stocks held at subsidiary plants. Trade information suggests it has reduced its commitments to deliver in October to about one-third of its September amounts. Shortage of copper in the U.S. could be serious late in October. Fabricators in the U.S. entered the strike period with about 520,000 tons of copper; this copper was in the form of stocked products, metal in process of fabrication and raw copper. Though it meant their customers had little reason to expect a failure to deliver in October, the fabricating plants might have to cut operations owing to failure to get raw copper. There were heavy imports of refined copper in September—not only large producers but merchants brought in much more than usual. This eased the possible pinch but it seemed probable a dock strike would hold up imports in October. This, added to the strike at copper producing facilities in the U.S., could close down a number of plants. By the end of September some wire mills were already short of wire bars and had indicated they might be forced to close soon.

Refined copper output in the U.S. in August dropped to 79,860 short tons from 134,020 in July according to the Copper Institute. Stocks dropped to 92,-175 tons. Some analysts say much of this copper is in shapes that can not be used by many fabricators. Mine output dropped to 53,247 tons from 81,662 in July.

Other data show copper fabricator stocks dropped to 487,259 tons in August —this is down about 31,000 tons.

Sept. 1 the LME spot bid was £238; on Sept. 30 it was £227. Few wanted to buy contracts on the exchange during the strike and those who had bought earlier felt they would get a better price now than later. Offers therefore appeared to outweigh demand for contracts and the quotations eased.

Kennecott's Braden properties in Chile were struck Oct. 2. Negotiations broke off on the new contract and as of Oct. 6 had not resumed. Braden produces about 190,000 tons per year. A Belgian Congo dock and inland transport strike was impeding exports. These boosted London about ⅝c. An East and Gulf Coast dock strike in the U.S. reduced imports of copper and copper materials by American Metal and others and threatened to boost merchant prices in the U.S.

Anaconda and Mine-Mill in the U.S. discontinued negotiations. The company said its costs were much to high to permit increasing wages as much as other firms that had settled earlier. It also said it was considering not reopening some of its facilities anyway.

Kennecott was scheduled to reopen negotiations with Mine-Mill October 1 and USW October 5.

Aluminum appeared to be in an uncertain situation. Aluminum Association data for August showed shipments of sheet, plate and foil at 58,307 short tons; July was 98,969 and the average for the first eight months was 76,187. The heavy July figure reflected accelerated shipments in anticipation of aluminum strikes and price increases. It might be that the third quarter average will not be low but many industry analysts feel it will be under the second quarter. Already poor sales have hit primary metal output. Though Reynolds had announced it was at 100% of capacity in the summer, industry talk was that they were now at less than 90%. The other two major U.S. producers had never gone to 100%. Aluminium Ltd. said it was raising its output to 533,000 tons annual rate from 500,000.

Conflict between mining firms and smelters showed up at the Mining Congress convention in Denver. It had broken through the surface when six major U.S. smelters presented a report to the Dept. of Commerce August 28 requesting that lead and zinc import quotas be rescinded and higher import duties be used instead. The six (they smelt about 53% of the primary lead in the U.S. and 46% of the zinc) want a rather wide spread between duties on ore and on metal. Miners fear dropping of quotas will not be offset by favorable import duties. Smelters feel the quotas have cut off too much foreign ore and made their operations too costly. They have implied quotas have reduced their share of the U.S. business and have been discriminatory. They suggest that if the same amount was imported, but more of it in ore and less in metal, the national employment and income would be raised by the additional smelting activity.

At the convention, Charles E. Schwab, then chairman of the lead-zinc emergency committee, said the smelters should exercise "self-discipline" in order to help the U.S. miners. He also suggested some doubt that miners and smelters would be able to get together in presenting their cases to the Tariff Commission in January.

Lead sales in September were the lowest on record. This reflected the heavy buying in August more than a shortage from strikes. American Bureau of Metal Statistics data for August show lead stocks held by U.S. smelters down about 18,-000 tons from July. But some observers consider the 124,259 now held as too high. They suggest that if the strikes were to end soon lead would be weak.

Zinc, many analysts say, is stronger than lead. Zinc sales were about at a record in September. Most of the sales were concentrated in one or two days. They were made to get in on the 11c price. St. Joseph Lead Co. raised to 12c East St. Louis Sept. 21. Probably the highest sales ever made in one day were made on the 21st and at the 11c price. Few sellers expect buyers will be in the market for even moderate amounts now. Some of the sales were made for delivery in November and December. Some suggest that when the steel strike ends there will be some fair buying of Prime Western.

Premiums for Special High and High Grade were raised ¼c September 1. The former went to 1½c and the latter to 1¼c. This was actually a recovery of some of the drop in premiums that occurred as the market weakened earlier. But such increases do not ordinarily increase the amount paid for concentrates and there were reports miners were displeased by the failure to raise Prime Western at that time. Some factors had held that zinc prices were not raised earlier in the year because ore buyers felt they would then be paying a higher price for ore which might be stocked during a steel strike. Metal prices might fall later and smelters would be stuck with a high priced inventory.

Average Prices September *(E&MJ Quotations)*

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	31.018
Electrolytic, export refinery	28.015
Electrolytic, c.i.f. Cont'l ports	28.960
Lead:	
Common, New York	13.000
Common, St. Louis	12.800
Silver	
Silver, New York, per oz	91.399
Silver, London, pence per oz	78.898
Zinc:	
Prime, Western, East St. Louis	11.334
Prime, Western, delivered (g)	11.834
Tin:	
New York Straits	102.435
Gold, per oz, U.S. price	$35.000
Sterling Exchange	280.370
Quicksilver, per flask	$223.810
Antimony (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony, for 99½%	24.500
Platinum, refined, per oz	$77.000
Cadmium (a)	120.000
Cadmium (b)	130.000
Al, 99½% dom., ingot	26.800
export, pig	22.500
Magnesium, ingot	35.250
Nickel (f)	74.000
Bismuth	$2.250
Cobalt	$1.750

Domestic quotations, unless otherwise stated, are in cents per lb. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.a.b. New York.
(f) Contract price, f.a.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

Custom Smelter Copper

Based on flat price and E&MJ average prices sales in U.S. for month of September reported by American Smelting & Refining Co.; electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered consumers' plant	31.250 lb
F. o. b. refinery	30.850 lb

Free Gold Market

International gold trading volume increased 7½% in September. Transactions in Paris showed a marked decline while London dealings were also lower. Near Eastern purchases remained normal and South American turnovers were light. There were very little price fluctuations as bar gold rose fractionally in London and Paris and coins were practically unchanged. No Soviet gold sales were reported. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Aug. 31	Sept. 30	Aug. 31	Sept. 30
New York transit			$35.08½	$35.08½
Manila	$41.85	$41.75	36.00	36.10
Hong Kong	46.00	46.00	38.45	38.85
Bombay	59.00	58.75	57.50	57.00
Tangier	40.35	40.25	35.25	35.30
Beirut	40.50	40.70	35.18½	35.18½
Paris	40.50	40.55	35.45	35.60
Buenos Aires	39.60	39.55	35.25	36.40

Note: The prices are quoted at the free or black market value of the U.S. dollar in the local markets.

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Sept. 1959	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99% U. S. Dest.	Straits Tin New York
1	31.550	28.700	29.645	13.000	12.800	11.500	11.000	24.700	102.625
2	31.475	28.775	29.720	13.000	12.800	11.500	11.000	24.400	102.375
3	30.775	28.700	29.645	13.000	12.800	11.500	11.000	24.700	102.375
4	30.550	28.775	29.720	13.000	12.800	11.500	11.000	24.700	102.125
7	Holiday	28.750	29.695			Holiday			
8	30.700	28.725	29.670	13.000	12.800	11.500	11.000	24.700	102.000
9	30.875	28.800	29.745	13.000	12.800	11.500	11.000	24.700	102.000
10	30.950	28.400	29.345	13.000	12.800	11.500	11.000	24.700	102.000
11	30.975	28.300	29.245	13.000	12.800	11.500	11.000	24.700	102.125
14	30.975	28.050	28.995	13.000	12.800	11.500	11.000	24.700	102.250
15	30.900	27.675	28.620	13.000	12.800	11.500	11.000	24.700	102.375
16	30.950	27.475	28.420	13.000	12.800	11.500	11.000	24.700	102.625
17	31.075	27.450	28.395	13.000	12.800	11.500	11.000	24.700	102.875
18	31.000	27.500	28.445	13.000	12.800	11.500	11.000	24.700	102.875
21	30.975	27.325	28.270	13.000	12.800	11.505	11.005	24.700	102.625
22	31.025	27.325	28.270	13.000	12.800	12.500	12.000	24.700	102.500
23	30.975	27.375	28.320	13.000	12.800	12.500	12.000	24.700	102.375
24	31.100	27.550	28.495	13.000	12.800	12.500	12.000	24.700	102.500
25	31.100	27.675	28.620	13.000	12.800	12.500	12.000	24.700	102.750
28	31.125	27.725	28.670	13.000	12.800	12.500	12.000	24.700	102.500
29	31.175	27.600	28.545	13.000	12.800	12.500	12.000	24.700	102.500
30	31.150	27.675	28.620	13.000	12.800	12.500	12.000	24.700	102.750
AVERAGES FOR MONTH									
Sept.	31.018	28.015	28.960	13.000	12.800	11.834	11.334	24.700	102.435
AVERAGES FOR WEEK									
Sept.									
2	31.185	28.615	29.560	13.000	12.800	11.500	11.000	24.700	102.800
9	30.725	28.750	29.695	13.000	12.800	11.500	11.000	24.700	102.125
16	30.950	27.980	28.925	13.000	12.800	11.500	11.000	24.700	102.275
23	31.010	27.395	28.340	13.000	12.800	11.901	11.401	24.700	102.650
30	31.130	27.645	28.590	13.000	12.800	12.500	12.000	24.700	102.600
CALENDAR WEEK AVERAGES									
Sept.									
4	30.935	28.770	29.715	13.000	12.800	11.500	11.000	24.700	102.500
11	30.875	28.595	29.540	13.000	12.800	11.500	11.000	24.700	102.031
18	30.980	27.630	28.575	13.000	12.800	11.500	11.000	24.700	102.600
25	31.035	27.450	28.395	13.000	12.800	12.301	11.801	24.700	102.530

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per lb., the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.13c per lb. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective Sept. 2, 1959, commanded a premium of 1.25c per lb over the current market for Prime Western; Special High Grade 1.50 effective Sept. 2, 1959.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U.S. lead is corroding grade).

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Sept. 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.625	78.750d.	280.3500	250s. 5d.
2	91.625	78.750d.	280.0800	250s. 8½d.
3	91.375	78.750d.	280.1920	250s. 9d.
4	91.375	78.750d.	280.2800	250s. 8d.
7	Holiday	78.750d.	Holiday	250s. 8½d.
8	91.375	78.750d.	280.2000	250s. 7¾d.
9	91.375	78.750d.	280.2350	250s. 7½d.
10	91.375	78.750d.	280.2250	250s. 7¾d.
11	91.375	78.750d.	280.1300	250s. 8½d.
14	91.375	79.000d.	280.2760	250s. 8d.
15	91.375	79.000d.	280.4180	250s. 7¼d.
16	91.375	79.000d.	280.3820	250s. 4¾d.
17	91.375	79.000d.	280.4400	250s. 6¼d.
18	91.375	79.000d.	280.5460	250s. 5d.
21	91.375	79.000d.	280.5500	250s. 4½d.
22	91.375	79.000d.	280.6400	250s. 4¼d.
23	91.375	79.000d.	280.7600	250s. 3d.
24	91.375	79.000d.	280.5680	250s. 3½d.
25	91.375	79.000d.	280.5600	250s. 4¾d.
28	91.375	79.000d.	280.3520	250s. 5¾d.
29	91.375	79.000d.	280.2400	250s. 8½d.
30	91.375	79.000d.	280.3560	250s. 7¾d.
AVERAGES FOR MONTH				
Sept.	91.399	78.898d.	280.370	—
AVERAGES FOR WEEK				
Sept.				
2	91.575	—	280.474	—
9	91.375	—	280.227	—
16	91.375	—	280.286	—
23	91.375	—	280.587	—
30	91.375	—	280.415	—

Calendar Week Averages: New York Silver: Sept. 4, 91.525; Sept. 11, 91.375; Sept. 18, 91.375; Sept. 25, 91.375.

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver 999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy oz 1000 fine effective July 1, 1946. London silver in pence per troy oz, basis 999 fine.

(d) U.S. Treasury's gold price is $35. Actual payment by the U.S. Treasury for gold is at 99.75% of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Sept.	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1	238	238½	235½	235¾	72½	72½	73¾	73½	86½	86¾	85	85½	791½	792	791½	792
2	237	237¼	234¾	235	71½	71¾	73½	73¾	86	86½	85	85¾	792	792½	792	792½
3	235¾	236	234	234½	71¾	72	72¾	73	85½	85¾	84½	84¾	792	792½	792	792½
4	235¾	236	234½	234¾	71¾	72	73½	73½	86¼	86½	85½	85¾	791½	792	791½	792
7	236¾	237	235¼	235½	71¾	71¾	73	73½	86¼	86½	85	85¼	792½	793	792	792½
8	236½	236¾	235½	235¾	71¾	71¾	73½	73¼	87	87¼	85¾	85½	792½	793	792	792½
9	236	236¼	235¼	235½	71¾	72	73½	73¼	86⅞	87	85¼	85½	793	793½	792	792½
10	232½	232¾	232	232½	71½	71¾	72¾	72½	86¾	86¼	85½	85¼	793	793½	792	792½
11	232¼	232½	232¼	232½	70¾	70¾	72⅞	72¼	86¼	86¾	85½	85¾	793	793½	792½	793½
14	229½	229¾	230¼	230¾	70¾	70¾	72	72½	86¼	86½	85½	85¼	792½	793½	792½	793½
15	226½	226¾	227½	228	70¾	71	72¼	72½	85¼	85½	85	85¾	793	793½	793½	794
16	225¼	225½	226½	226¾	70½	70¾	71¾	72	85¾	86	84¾	85	793	793½	793	793½
17	226¾	227	228	228½	70⅞	71¼	72½	72¼	86	86¼	85	85¼	793	793½	793½	794½
18	225¼	225½	226¾	227½	70½	71	72	72½	86	86½	85½	85¾	793	793½	793½	794
21	224¼	224½	225	225½	69¼	69½	70¾	71	84½	84¾	83¾	84	792½	793	791½	792½
22	224¼	224½	225¼	225½	69¾	69¾	70½	71	85½	85¾	84½	85	791	792	790½	791
23	225½	225¾	226	226½	69¾	69¾	70¾	71	85	85¼	84¼	84½	791	791½	790¾	791
24	227	227¼	227¾	228	69¾	69⅞	71	71¼	85¼	85½	84¼	84½	793	793½	790½	791
25	229	229¼	229¾	230	69¾	69⅞	71½	71¾	85½	85¾	84¾	84¼	793	793½	792	792½
28	228	228¼	228½	228¾	69⅝	69¾	71⅝	71¾	85¾	86	85	85¼	793	793½	792	792½
29	227	227¼	227¾	228	69	69½	70½	70¾	85½	85¾	84¾	85	792	792½	791	791½
30	227	227¼	228	228¼	69½	69½	70⅞	71	87¼	87¾	85¾	85¾	793½	794	793	793½
Av'g's	£230.378		£230.432		£70.722		£72.088		£86.071		£84.991		£792.750		£792.318	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.9%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty paid.

MISCELLANEOUS METALS

Sept. 30, 1959

Aluminum ingot, 99 plus % lb		26.8c
Antimony, spot, lb, less than carload, in cases		32.5c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported. 10 ton min. (p), 99½%		24½c
Bismuth, ton lots, lb		$2.25
Cadmium, small lots, commercial sticks, delivered, lb		$1.20
small lots		$1.30
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb, contract delivered		$1.29
Cobalt, 97 to 99%, per lb effective Feb. 1, 1957		$1.75
Germanium, per gram, 10,000 gram lots	(d) 33c	—(c)(d)35c
Indium, troy os	$1.25	— $2.25
Lithium, lb, 98%	$9.00	— $11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc.		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35½c
Palladium, troy os	$18.00	— $20.00
Platinum, troy os	$76	— $80
Quicksilver, flask of 76 lb, 25 flasks or more	$223	— $226
Selenium, 99 plus %, lb—(Feb. 19, 1958)		$7.00
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$2.50
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50	— $1.60

(a) Effective Dec. 6, 1956; including U.S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu: spot		$32–32.50
term contracts		$34–34.50
Chrome ore per long ton, f.o.b cars Atlantic ports, dry:		
44% Cr_2O_3 no ratio	$18	— $19
48% Cr_2O_3 3 to 1 ratio	$35	— $39½
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$156.12

Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra. 87c—90c. Long-term contract nominal. Indian government export duty discontinued Nov. 24, 1938.

Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbian-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.10	— $1.20
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U.S. ports, duty extra		$17.50
U. S. scheelite, f.o.b. mill	$22	— $25
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton		$68

(a) Nominal. (b) c.i.f. U.S. ports. (e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl. carload lots N. Y. docks		4–5c
Cobalt oxide, 72¼% to 73¼%, per lb, effective Dec. 1, 1956	$1.33	— $1.36
Copper sulphate, 100 lb, effective July 14, '59		$11.95
Germanium dioxide, gm		18½c
Molybdic trioxide, technical, per lb of Mo	$1.46	— $1.47
Imported, including 37c duty	$1.75	— $2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		12¼c
Ferramolybdenum, 58 to 64% Mo. Lb of Mo contained	$1.50	— $1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20	— $3.40
Silicomanganese, max. 1½% c, lb contracts		12.8c
Spiegeleisen, per lt, 10—21% grade effective Jan. 7		$102.50

NONMETALLIC MINERALS

Asbestos, f.o.b Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,400	— $1,810
Crude No. 2	$750	— $1,155
Spinning fibers	$370	— $600
Shingle fibers	$180	— $220
Paper stock	$120	— $145
Waste	$75	— $86
Shorts	$40	— $75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$220	— $787
Asbestos, Vermont, f.o.b. Morrisville:		
Spinning fibers	$370	— $428
Shingle stock	$181	— $200
Paper stock	$120	— $152
Waste, stucco or plaster		$86
Refuse or shorts	$41	— $75
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16	— $18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16	— $18
Bauxite, st, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried)	(c)$5.00	— $5.50
Domestic, chemical, 55 to 56%	(c)$8.00	— $8.50
Domestic, abrasive, 80 to 84%	(c)$18.00	— $18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, depending on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$20.50	— $21
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	— $41
60% effective CaF_2	$33	— $36.50
Acid 97% concentrate, bulk, ton (effective 12–1–56)		$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	— $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1½x2 in, 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in, $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00; 4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton. Bulk sales, dry ground; $30—$55 per ton. Scrap $20—$30.

Ocher Georgia, ton in sacks	$26.50	— $32.00
Pyrites, Spanish, per lt unit of S c.i.f. Atlantic ports		Not quoted
Sulphur, per lt f.o.b. U.S. mines: bright		$23.50
dark		$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40	— $31.60
For export f.o.b. vessel, lt, depending on grade	$22	— $24
Talc, f.o.b. works, ton:		
New York, purified	$18.00	— $20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30	— $5.50

"Imagination... is the source of human improvement; experience its implement"

Phillips Petroleum Company, Grants, New Mexico

URANIUM... AND THE PATTERN OF A NEW ERA

Today, the world is heir to countless miracles of the new era of atomic energy, thanks, in large measure, to uranium and the technological and scientific skills that have put it to work.

The interest of WKE engineers in this new age stems from experience in design, engineering and construction of twelve of the twenty-five operating or planned uranium plants in the United States. These twelve operations include a wide range of capacities, ore types, processes and specialized equipment. In each case, success has been the result of imaginative application of proved techniques in chemical metallurgy, beneficiation, materials handling and instrumentation, plus construction experience. WKE has successfully executed over forty contracts in this "new era" industry — from evaluations and feasibility reports through construction and start-up.

We invite your inquiry for more detailed information on the WKE record in uranium and other industries, and the WKE approach that means more plant per dollar spent.

WKE®

WESTERN-KNAPP ENGINEERING CO.
SAN FRANCISCO • New York • Chicago • Hibbing

Building for the Future—in a World of Industries

Why Canadian firm uses 22-ton off-road haulers 1,000′ underground

In a mining operation 1,000′ underground, where entry is possible only through comparatively narrow "straight up" shafts, you'd hardly expect to see big, heavy-duty diesel haulers at work. Yet, at its Ojibway Mine, just south of Windsor, Ont., The Canadian Rock Salt Co., Ltd. uses eight 22-ton LeTourneau-Westinghouse C Tournapull® Rear-Dumps . . . units so big they had to be cut apart for lowering through the shafts, then reassembled below.

Why did this firm choose these LW machines rather than the specialized low-slung haulers that might have been used?

Short turning radius . . .

Mine Superintendent J. E. Crawford says, "Because we think they're tops. Their short turning-radius gives us the maneuverability we require. Their electrical system speeds the work. And because we can use their electric power to trigger blasts.

◀ At the Ojibway Mine, the work floor is 975′ from earth's surface and connected by 2 shafts. There are 12 miles of galleries in the mine, and the figure is growing. Broken salt is conveyor-loaded into the "C's", which carry it an average 1000′ distance to a primary crusher. Primary crushed material is elevated to surface in 12-ton loads for final processing and shipment.

In a gallery of the 1,000'-deep Ojibway Mine near Windsor, Ont., newly-blasted rock salt is loaded into a 22-ton LeTourneau-Westinghouse C Rear-Dump. Canadian Rock Salt Company uses 8 of them to haul material from blast site to crusher. Output is 5,000 tons a day.

Dumping is electric motor-controlled for quick discharge of rock salt load. Material flows through grate into primary crusher. Pieces too large to pass grate are broken up by a pneumatic drill. Crushed salt is carried 2,000' by conveyor belt to elevator-buckets for lifting to surface.

"For our type of operation these machines are A-1! Their maintenance costs are low. Actually, we've had no breakdown on our older LW units in over 17,000 hours of operation."

"Stand up to it and keep going"

And Canadian Rock Salt's Master Mechanic John Reid adds: "These 'C's' are 100%. They've done a tremendous job for us. We put on about 6,000 hours a year . . . with a lot of problems you don't have in surface work . . . such as rock wall curbs and sharp corners. These units have been able to stand up to it and keep going."

Check these photos of how LW Rear-Dumps are serving Canadian Rock Salt Co. . . . then let us help you decide how these fast, rugged machines can serve *you*. They're available in three sizes, the 138-hp, 11-ton "D"; the 226-hp, 22-ton "C"; and 360-hp, 35-ton "B". A call or card will bring you full information. No obligation.

Rear-Dumps disassembled for trip to mine floor

Rear-Dumps are cut into sections.

Parts must be carefully positioned.

Assemblies are lowered to 975-ft. depth.

Rear-Dumps are rebuilt in mine gallery.

Complete again . . . and ready for heavy work.

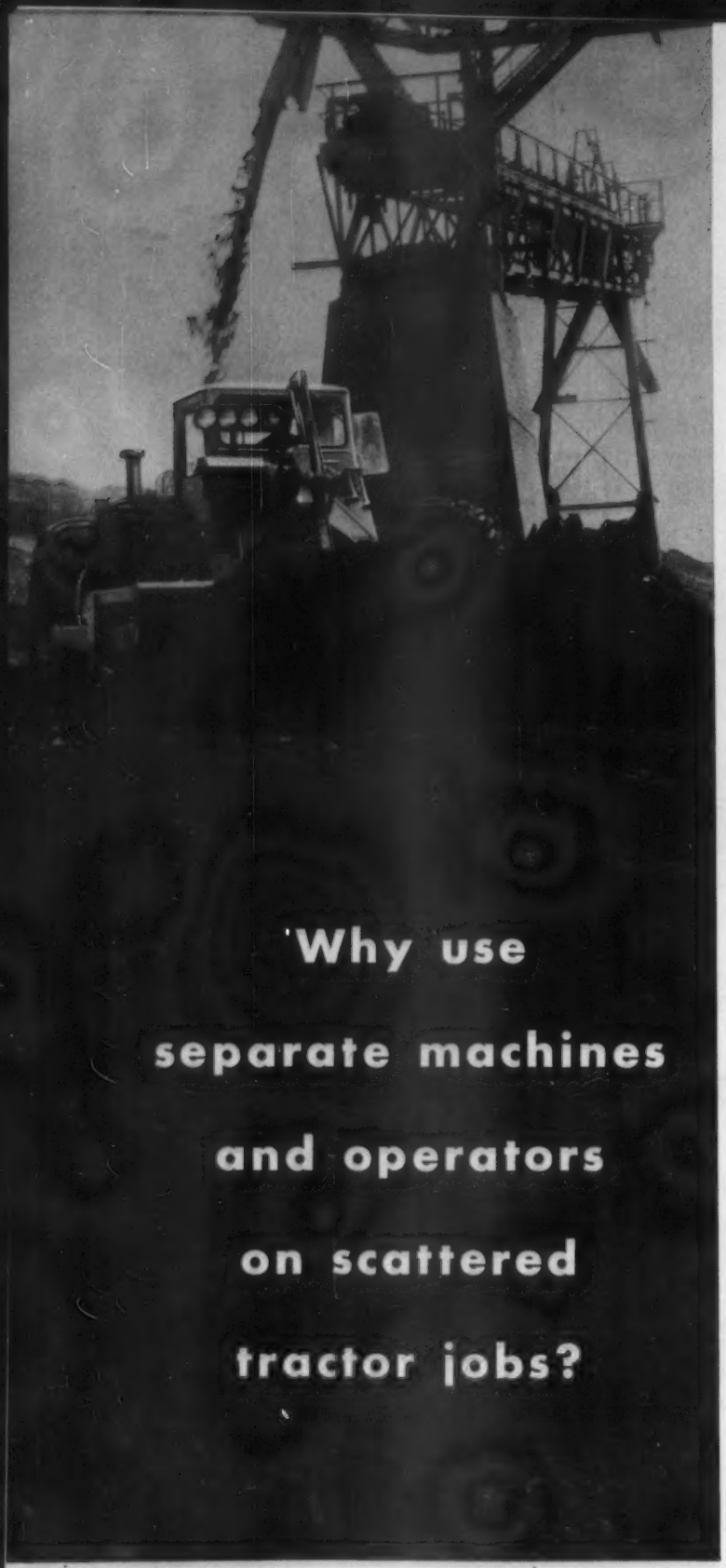
CR-2092-MJ-2

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

General Construction Company



Why use separate machines and operators on scattered tractor jobs?

Handle your widely-separated pit maintenance and clean-up jobs swiftly and economically with one man and a LeTourneau-Westinghouse Tournatractor®. This rubber-tired tractor speeds to the job under its own power . . . over paved roads, down shot-banks, cross-country or over railroad tracks. There are no delays while tractor crawls to new locations.

LW tractor gives you better speed at the work area, too. Acceleration is fast, with 218-hp operating through sealed anti-friction drive. Maneuverability is quick and easy. Also, there's no loss of momentum to shift gears, because this tractor's gears are constantly in mesh. Even reverse action is *instant*.

Handles wide variety of jobs

You can use just one Tournatractor to clean-up around 2 or more shovels . . . and at the same time maintain stock-piles, level waste dumps, clean debris off RR tracks, clean benches, handle shallow stripping, tow air-compressors, or pull supply and service wagons. You can even use this speedy, mobile tractor for maintenance and clean-up in one or more adjoining pits.

Biggest tractor value today!

In addition to giving you these plus operating advantages, LeTourneau-Westinghouse Tournatractor *costs less* to own, and *much less* to maintain than a track-type tractor of comparable horsepower. Let us demonstrate this rubber-tired tractor at your pit. Watch Tournatractor perform under *your* working conditions. You'll find it can handle scattered tractor jobs faster, more efficiently, to help cut your tractor costs.

◀ Powerful LW Tournatractor spreads and compacts conveyor-dumped mineral-bearing soil. At this plant, mobile rubber-tired tractor also pulls rail cars, handles dump maintenance, and operates a towed scraper.

CT-2101-MQI-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

General Construction Company workmen core drill a 4-inch hole through existing Interstate Bridge piers.

DIAMONDS MEAN . . .
BRIDGE RECONSTRUCTION

PROBLEM SOLVED!

Christensen Custom Designed Diamond Equipment Aids in Interstate Bridge Reconstruction

Raising the Interstate Bridge between Portland, Oregon and Vancouver, Washington is a mammoth job that demands specialized equipment. The reconstruction of the Interstate Bridge is under the supervision of the Oregon State Highway Department, A. A. Rear, Resident Engineer. Aimed at providing additional vertical clearance for Columbia River traffic, five concrete piers are being heightened as much as 38 feet, requiring enlargement of their bases with new concrete. To tie the new concrete to the old, 45 holes were core drilled. These holes were 14 feet long and four inches in diameter to allow insertion of heavy steel rods. These tensioned rods, projecting six feet from each end of the holes, assure proper adherence of the new concrete to the existing bases. The special bit and core barrel necessary for this job were designed and manufactured by Christensen under the supervision of T. R. Harris, General Superintendent, General Construction Company of Portland. This unique equipment was specifically designed to operate economically in a confined space 40 feet below the river surface. Maximum efficiency and complete customer satisfaction were achieved.

If you have a unique operation or a particularly difficult drilling problem that requires specialized equipment, consult Christensen about diamond drilling equipment manufactured to your requirements.

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

NOW! REPUBLIC BRINGS YOU 3 MAJOR ADVANCEMENTS IN MINE ROOF BOLTING*

HERE'S THE ASSEMBLED UNIT WITH REPUBLIC RS-1 EXPANSION SHELL

Advanced, all-purpose RS-1 has strong, flexible leaves for simple installation, and quick, efficient tightening. Narrow base support for the leaves assures easy, dependable expansion.

Republic offers the largest combination of roof bolts, roof plates, and expansion shell assemblies available —for virtually any application, in any type of formation. Get details now.

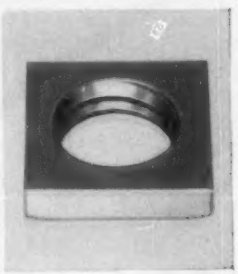
MATERIAL CONTROL CERTIFICATE with every Republic Roof Bolt shipment gives specific physical properties of steel used. Data includes yield point in pounds per square inch, yield and break point in pounds, other information. Guesswork about performance is eliminated!

1 PRECISION-TAPERED PLUG

Engineered for proper shell expansion. Note angle of taper in illustration—the precise degree required for strength, dependability, and quick, efficient tightening. This improved Republic plug is versatile and adaptable, and is particularly effective in relatively soft formations.

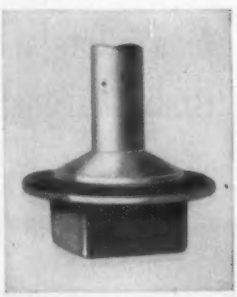
2 HEAVY-DUTY SUPPORT NUT

Square nut provides over 40% better support than even the best previous method, yet maintains proper bolt tension by stripping at approximately 50 pounds torque with no damage to bolt threads . . . can be applied either side up to expedite assembly.



3 IMPROVED SELF-CENTERING HEAD

Compact, one-piece head eliminates need for second washer. Heavy flange, and thick, reinforced washer are guided cleanly and firmly into position in bolt plate. Entire unit forged, for ruggedness and strength. Standard 1⅛" head available with ¼" and ⅜" bolt sizes.



*Complete Unit Can Be Shipped Fully Assembled

. . . as shown at left . . . to prevent loss of parts, prevent damage to bolt threads, save you assembly costs.

Specify Republic Roof Bolt Plates, Too!

SUPERIOR PERFORMANCE OF REPUBLIC ENDURO® STAINLESS STEEL used for this cleaning plant shaker screen has drastically reduced replacement expense. Reason is the excellent resistance of Republic Stainless to abrasion and corrosion. Other characteristics which pay service dividends in mine equipment applications include its good strength-to-weight ratio, easy cleanability, and high impact strength. In addition, Republic Stainless Steel is readily formed and welded, simplifying both manufacturing and maintenance operations. Mail coupon.

THE STRENGTH OF STEEL PLUS THE CORROSION-RESISTANCE OF PLASTIC are provided by Republic "Dekoron®-Coated" ELECTRUNITE® E.M.T. When properly installed, this versatile electrical raceway gives your circuits long-lasting protection against corrosive fumes, gases, and vapors. What's more, the extruded plastic armor of "Dekoron-Coated" ELECTRUNITE does not materially interfere with installation. Only ordinary tools are required. Joints are corrosion-protected by wrapping with pressure-sensitive plastic tape. Also available in rigid steel conduit. Send coupon for complete facts.

EXCELLENT SERVICE IN HANDLING MINE WATER is provided by Republic Flexible Plastic Pipe. Made of tough polyethylene, it is easy to handle in cramped quarters and conforms readily to irregular contours. Light weight and easy cutting and joining simplify installation. Relocation to meet changing conditions ceases to be a problem. Republic Flexible Plastic Pipe is impervious to the corrosive elements normally found in mine water, assuring years of trouble-free operation. Mail coupon for further information.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. EJ-7944-A
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

☐ Mine Roof Bolts ☐ Stainless Steel
☐ FE Plastic Pipe ☐ Dekoron-Coated E.M.T.

Name_____ Title_____

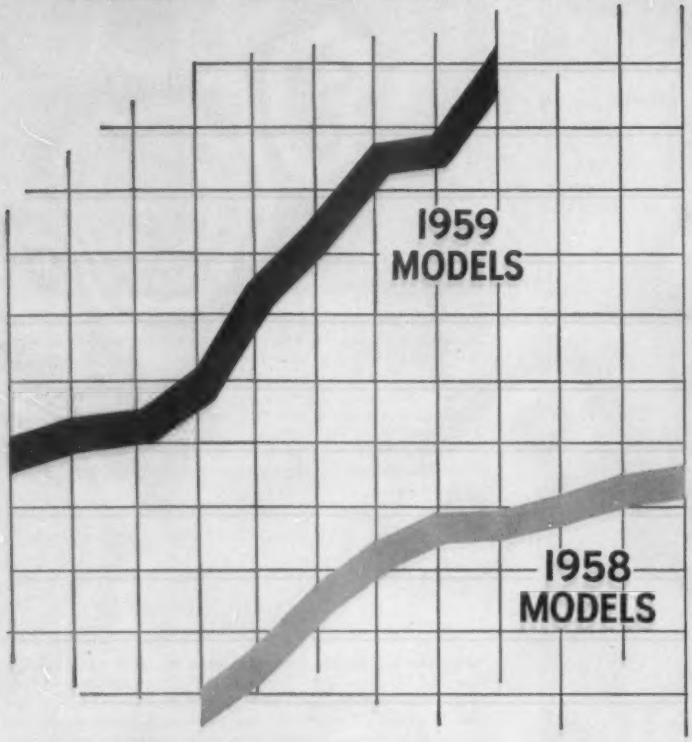
Company_____

Address_____

City_____ Zone_____ State_____

The BIG SUCCESS

1959 FORD SUPER DUTY TRUCK SALES MORE THAN DOUBLE THOSE OF LAST YEAR



1960 FORD SUPER DUTIES

SKYROCKETING SALES OFFER ADDED TESTIMONY TO THE TOUGHNESS AND RELIABILITY OF FORD "BIG V'S"— *NOW THEY'RE MORE DURABLE, MORE FLEXIBLE THAN EVER!*

Ford's increase in sales of Super Duty Trucks, while impressive in itself, by no means tells the whole story. Over half of the 1959 unit sales were the result of repeat orders from operators like Trucking Contractors, Inc., who bought because the Ford "Big V" provided the kind of performance and durability needed for their work.

And for 1960, the Ford Super Duties offer additional refinements designed to provide an even greater degree of dependability. Bigger optional axles and increased GVW's permit greater payloads and more profitable operation. Automatic radiator shutters to keep the engine temperatures within the most efficient operating range, submerged-type electric fuel pump to prevent vapor lock, and redesigned wiring for longer, more dependable operation are but a few of the improvements which add to the performance and durability of these units.

The changes offered for 1960 were tested and evaluated by America's foremost independent automotive research organization. The certified results of the studies by this impartial firm (name available on request) provide proof that Ford's Super Duty Trucks are even more dependable.

- **Certified Durability through closer temperature control!** Independent research engineers certify that Ford's thermostatically controlled radiator shutters kept water temperature between 168° and 188° in severe mountain grade operation. The test truck with shutters blocked open

of the Big Truck Field

"Tried 8 in '58—bought 20 more in 1959," says Curtis E. Brost, President, Trucking Contractors, Inc. "In 1958 we bought 8 Ford T-850's with lightweight chassis options and specially built 5-batch bodies which gave us a full extra batch per truck. A 5-batch load is a real strain on the truck when you consider we're 'running the ditches' on this highway paving job in North Dakota. These T-850's worked out so well that we ordered 20 more in '59. Our Ford Tandems with the 477 engine give us good mileage and the drivers are real happy with them. It's a rough go on trucks with soft footing and dust so bad we have to drive with headlights on. Despite such operating conditions, downtime has been negligible and these '477' Fords have given us less trouble than other trucks we have operated."

with Certified Durability

under same operating conditions had a temperature range from 102° to 181°. The temperature variation of only 20° with shutters means less expansion and contraction in engine block and cylinder heads. Higher temperatures with radiator shutters permit leaner fuel-air mixtures with less possibility of raw gas washing down cylinder walls. Warm oil circulates more freely, reducing internal friction. All these factors contribute to longer engine life.

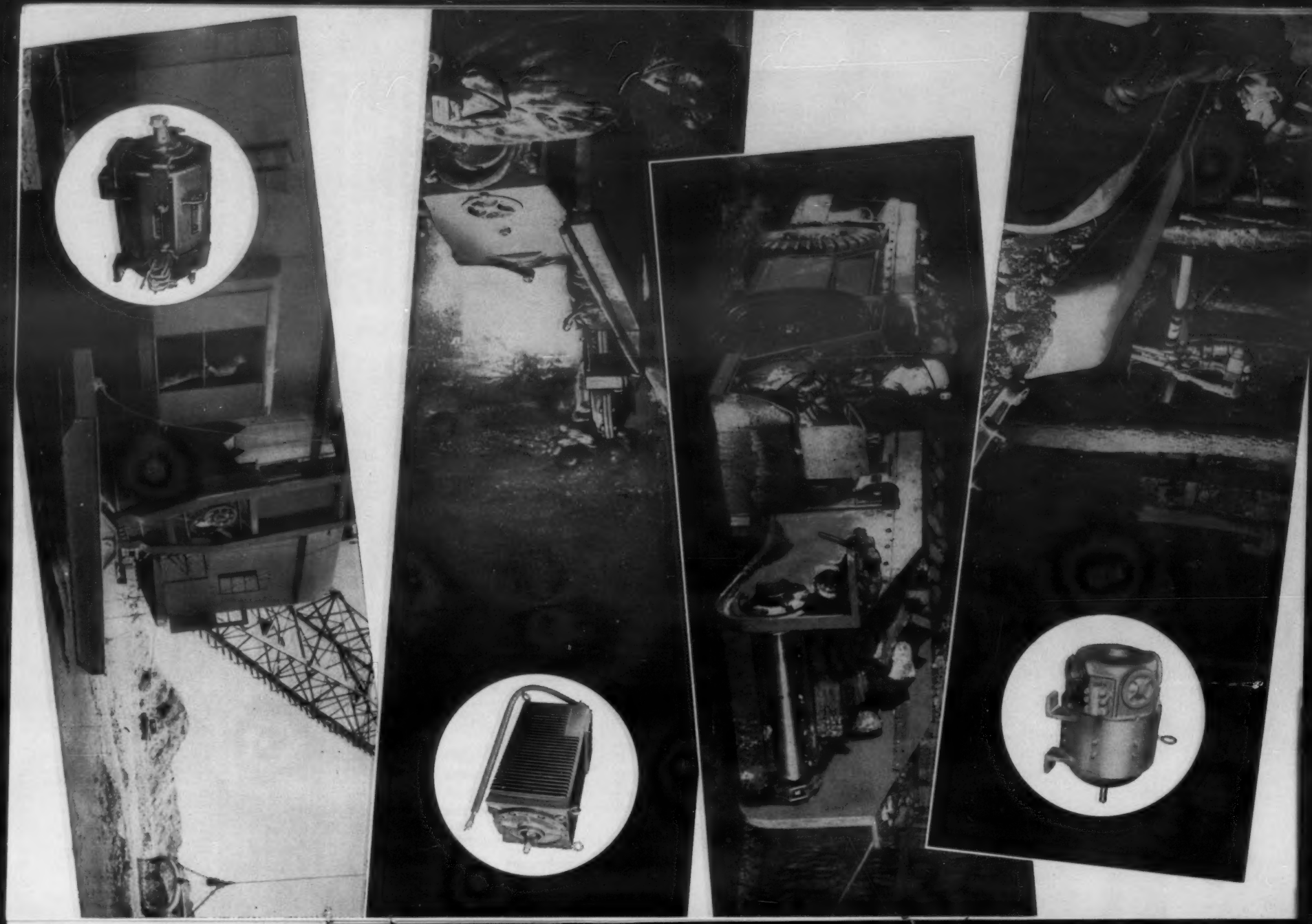
- **Certified Dependability with longer-lived electrical system!** Ford's '60 improved wiring harness and the 1959 wiring harness were subjected to shaker table tests plus constant exposure to oil and water vapors and temperatures of 200°. Certified results prove that the greater resistance to deterioration by heat, oil, water and abrasion obtained with the 1960 wiring harness more than doubles wiring harness life.

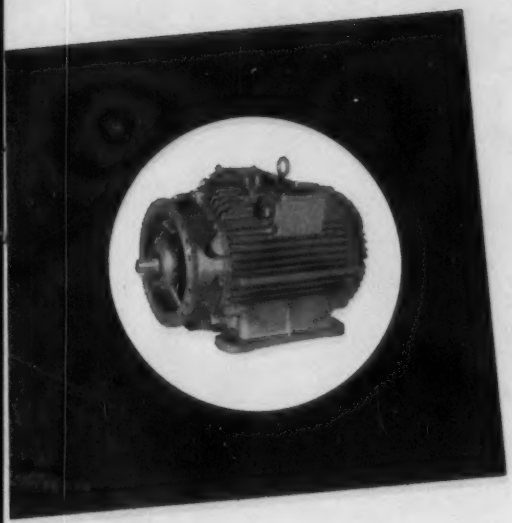
- **Certified Reliability with Ford's submerged-type electric fuel pump!** Dynamometer tests of engines with submerged-type electric fuel pump and conventional mechanical type showed that vapor lock was nonexistent with Ford's electric pumps at temperatures up to 200°, whereas incipient vapor lock with mechanical pump resulted in a power loss of 9% at an underhood temperature of 200°.

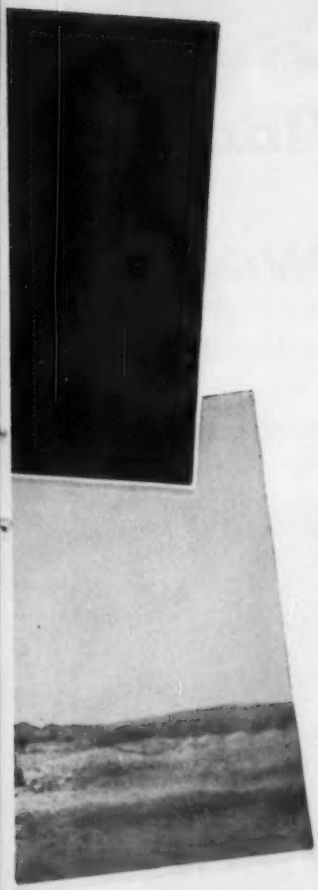
Test results like these plus the experience of satisfied users are important but that is not all. For 1960, the Super Duty line has been broadened to provide even more flexibility in power train options. Get the facts from your Ford Dealer!

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!







AC and DC

Westinghouse motors are job-proved for all mining applications

Regardless of whether you need a-c or d-c motors . . . regardless of the particular application . . . you'll find there's a Westinghouse motor to do the job . . . a motor which has proved itself time and again for rugged dependability and long operating life.

Combining the most modern materials with proven dependability and durability, Westinghouse motors will help you increase production through more efficient service . . . will help you decrease capital investment by giving you many extra years of reliable performance.

Westinghouse motors . . . either a-c or d-c . . . are available in all ratings, mountings, enclosures . . . standard or special design. Prompt delivery is backed by expert application and service-engineering assistance.

For complete information, contact your nearby Westinghouse representative. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J-22120

YOU CAN BE SURE... IF IT'S Westinghouse

Rope Stringer Conveyor

WITH NEW STYLE L TROUGHING IDLERS

Features:

- High idler frame design prevents belt damage due to runoff.
- Convenient one shot lubrication.
- Positive wire rope attachment with a double nut corner bolt prevents idler movement and belt detraining.
- Easy disassembly—rolls can be removed by loosening just four bolts.
- Idler rolls are interchangeable with one another.
- Under severe service conditions, return belt contacts center roll—not cross members.
- Only one size of wrench needed for all nuts and bolts.
- Full line—2¾″ to 5″ dia. idlers; commercial or precision roller bearings.

Installation is fast and easy, too. See your local H-R representative or write Hewitt-Robins, Stamford, Conn. Ask for Bulletin 10-16.

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THE NAME THAT MEANS EVERYTHING IN BULK MATERIALS HANDLING SYSTEMS...

CONVEYOR BELTING AND IDLERS • INDUSTRIAL HOSE • VIBRATING FEEDERS, SCREENS & SHAKEOUTS • POWER TRANSMISSION EQUIPMENT

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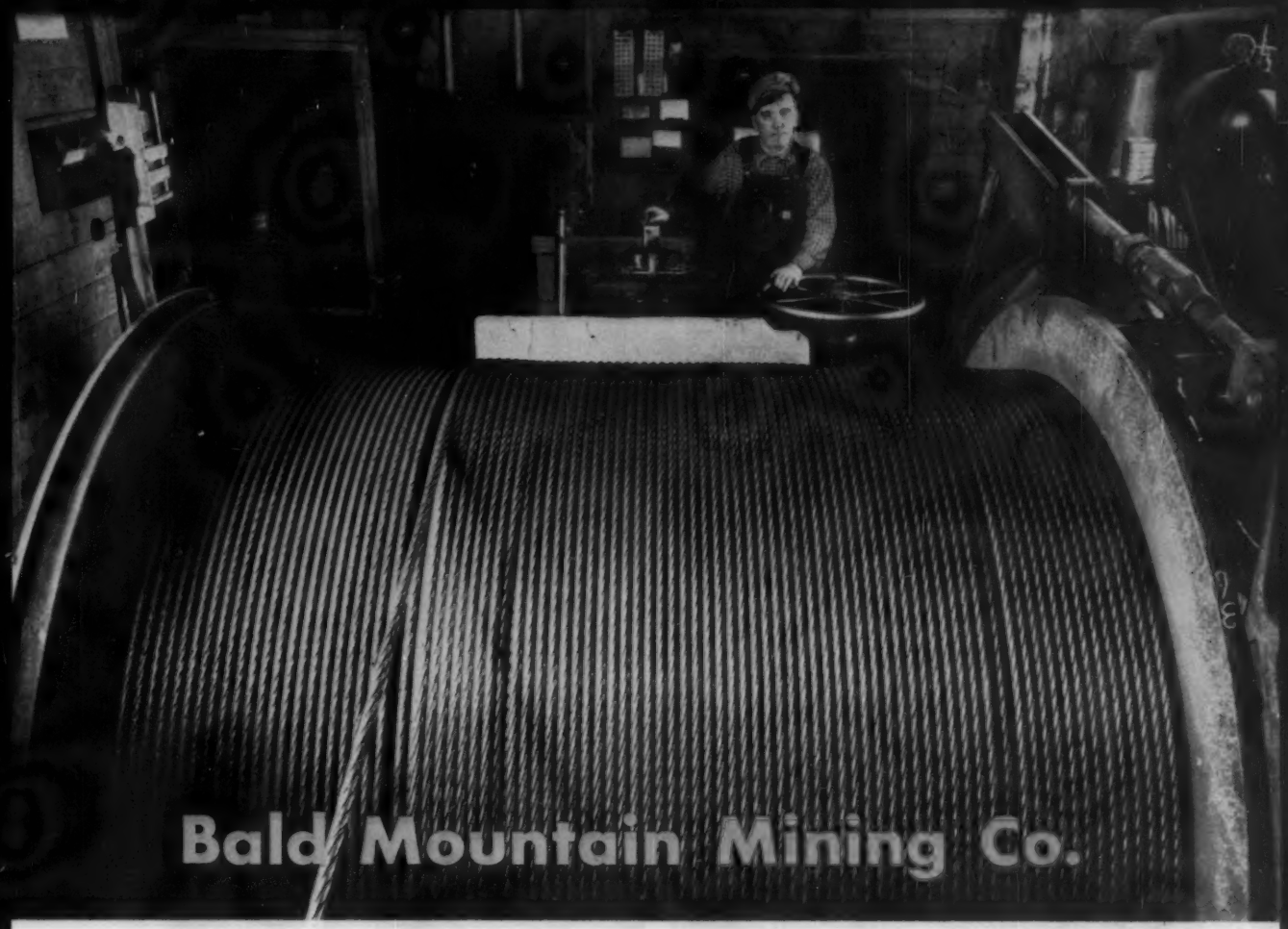

gets 21% longer rope life with Yellow Strand Flattened Strand

A service life increase of 42% over the 40-year average, and 21% over the best competitive ropes! That's the amazing record for Yellow Strand Flattened Strand told by Bald Mountain Mining Company at their mine near Trojan, South Dakota.

Using 4500′ of ¾″ 6x8 Yellow Strand Flattened Strand, ore cars are hauled up from the mine on one side of Bald Mountain . . . then lowered down the other side to the loading chute.

At rope speeds of 700-800 fpm, one string of Yellow Strand Flattened Strand helped move 97,000 tons of ore during its record 1⅓ years of service.

Exceptional service life like this can be yours, too.

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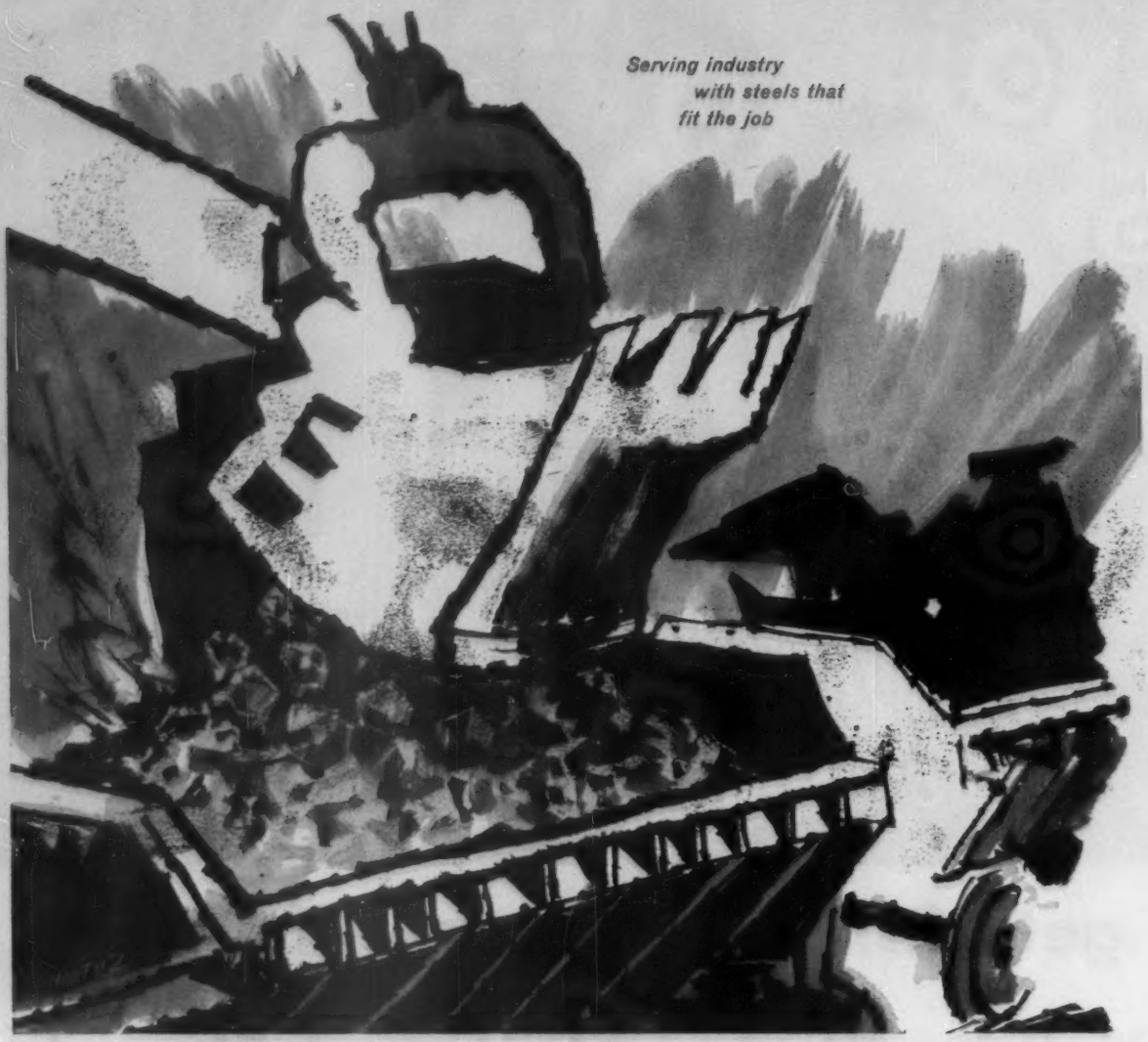
SLINGS

CLIPS

Serving industry with steels that fit the job



GET TOUGH

WITH LUKENS "T-1" STEEL

TRADEMARK

Where the going gets rough, versatile Lukens "T-1" steel fights back. For repair or modification of heavy duty equipment such as truck beds, chutes, bucket teeth and dozer blades, this special duty steel plate can be ordered from *warehouse stock* in a wide range of plate sizes and gages. Lukens "T-1" is the modern mining steel—you can work and weld it in the field as readily as in your shop. Its terrific resistance to abrasive impact—coupled with an extremely high yield strength—means fewer replacements and often greater payloads. That's why more and more equipment builders are using Lukens "T-1" to provide longer life in shovel buckets, trucks and other mining equipment. Remember to specify the extra-tough 321 min. BHN quality. For performance and application details, request our special booklet, "Lukens 'T-1' for Toughness." Address Manager, Application Engineering Dept., 109 Services Bldg., Lukens Steel Company, Coatesville, Pennsylvania.

These warehouses can supply you with Lukens "T-1" steel plate...

Alabama, BIRMINGHAM 2, O'Neal Steel, Inc., P.O. Box 2623 • **California,** LOS ANGELES 54, Earle M. Jorgensen Co., P.O. Box 2358, Terminal Annex, 10650 S. Alameda St. • LOS ANGELES 33, The R. J. M. Company, 238-248 South Mission Rd. • **Illinois,** CHICAGO 8, Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts. • **Kentucky,** ASHLAND, Mansbach Steel Co., 19th St. and River Front • **Maryland,** BALTIMORE 2, Wm. G. Wetherall, Inc. 317 President St. • **New Mexico,** ALBUQUERQUE, Miller and Smith Mfg. Co., Inc., 500 Phoenix Ave., N. W. • **Ohio,** CLEVELAND 6, Mills-Wolf Steel Co., 12434 Cedar Rd. • **Oregon,** PORTLAND 4, J. E. Haseltine & Co., 115 S. W. Second Ave. • **Pennsylvania,** McKEES ROCKS, Follansbee Metals Division, 200 Bradley St. • **Quebec,** MONTREAL, Drummond, McCall & Co., Ltd., 930 Wellington St. • **Utah,** SALT LAKE CITY, Structural Steel & Forge Co., P.O. Box 300 • **Washington,** SEATTLE 4, Stack Steel & Supply Co., 500 Landers St. • SPOKANE 10, Union Iron Works, East 217 Montgomery Ave., P.O. Box 2135.

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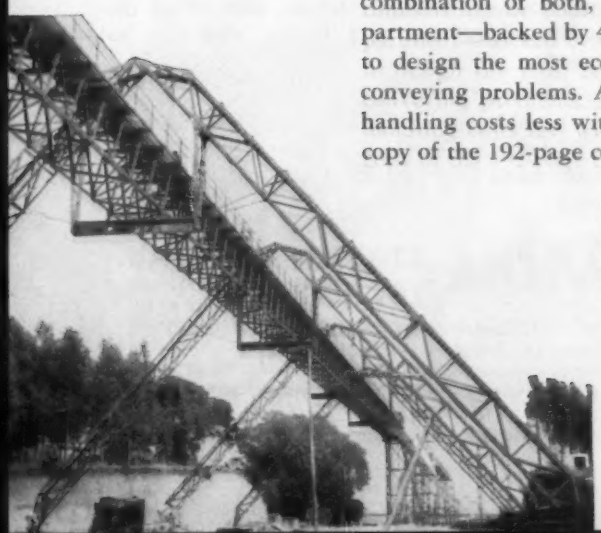
Whether your heavy-duty jobs call for all standardized components, all specially designed components, or a combination of both, Barber-Greene's engineering department—backed by 40 years' experience—stands ready to design the most economical answer to these special conveying problems. Any way you look at it, material handling costs less with Barber-Greene. Write for your copy of the 192-page conveyor catalog.

New Barber-Greene Heavy-Duty Idlers handle heaviest materials at high speeds. Heavy steel end brackets ribbed for maximum strength. Revolutionary grease seals most advanced in the industry.

59-16-PE



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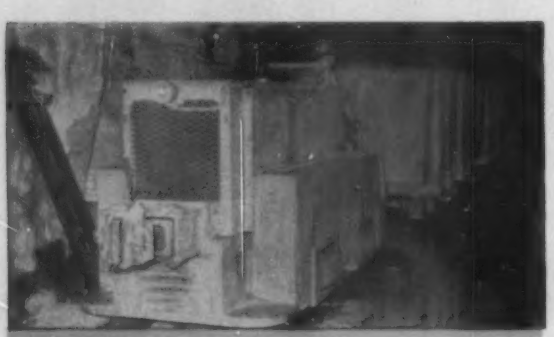

Mancha's D12CA, 12-ton

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Diesel—Unlimited haulage range. Preferred for main line adit and tunnel haulage where ventilation is not a problem. No permanent power installation required.

Where haulage efficiency is highest you'll find MANCHA Locomotives

In metal and non-metallic mines . . . in tunnels, for light tramming or heavy hauls, long distances or short . . . there's a Mancha locomotive to fill the need. And for each application a "job analysis" assures a unit to meet conditions . . . to provide top efficiency.

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Trolley—Most popular and lowest cost for continuous haulage demand where permanent installation is practical and trolley wire can be protected.

If you would like to know more about any of these Mancha locomotives or other sizes available for both mine and industrial applications, write us today.

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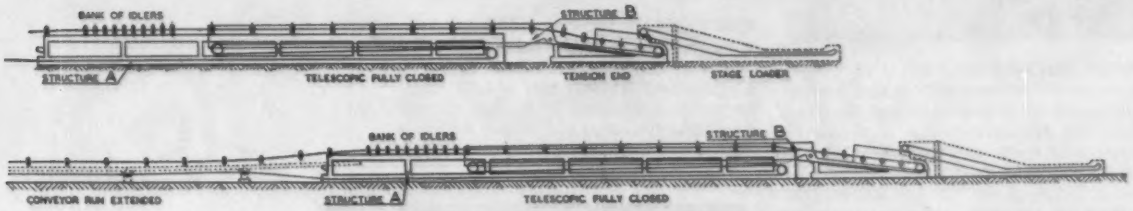
Mancha representatives are located in principal mining areas throughout the world.

NEW PRODUCTS DIGEST

In this issue—a visit through McGraw-Hill World News Service to the Mining Equipment Exhibition held in London, in July; a timber cage, a new skip, a floating strainer for sump pumps, a patented device that prevents filter cloth blinding, a non-blinding screen, a page of literature and E&MJ's reprint list.

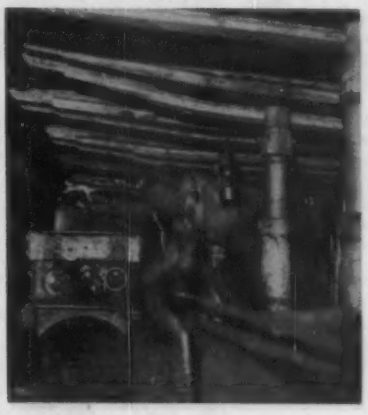


MECO ALSO displayed the extensible gate conveyor which can follow the advance of the workings in infinitely adjustable steps. Telescopic conveyor is a 30-ft unit and can be used with any conventional gate belt conveyor. The conveyor can advance while loading. When the advance has run the full 30 ft, the Telescopic is closed up forward and 30 ft of belting and conveyor stand are added out by the Telescopic and the advance continued. **(7)**

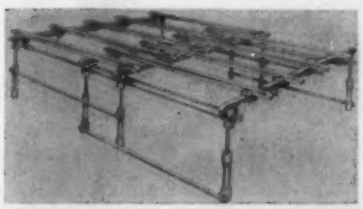
British Manufacturers Display Their Wares at Mining Equipment Exhibition

THOUSANDS—many from outside the British Isles—visited the Mining Machinery Exhibition arranged for the Grand Hall, Olympia, London, July 9 to 18, 1959 by the Council of Underground Machinery Manufacturers. In conjunction with the show, the Institute of Mining Engineers held a symposium on tunnelling and shaft sinking with participants from 12 countries. Items No. 1 to 11 shown below represent some of the highlights of the show. For more information on these and the other new product and literature items, circle the proper number on the readers' reply card and mail—with proper postage, your name and address—to E&MJ. The back side of the literature card contains the complete list of reprinted articles available from E&MJ. A separate readers' reply card is provided for your convenience in ordering these reprints—it is not a postal card. Circle the proper numbers for the reprints you want, enclose the card with proper amount of money in an envelope and mail to E&MJ.

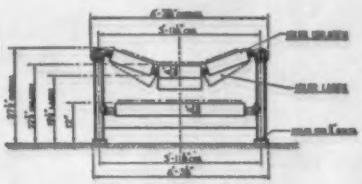
THE DUKE—a pit prop was tested right in the hall on a 100-ton rig to show that it can withstand high overloads. The Duke is rated at 20 tons and is available in six sizes to give heights ranging from 33 to 85 in. **(1)**



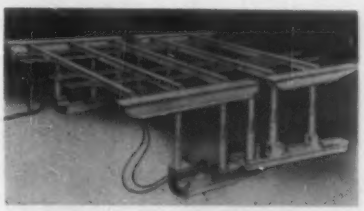
ROOFMASTER increases safety and productivity of British coal mines. It is a self-advancing hydraulic roof support system that has more than doubled the output of British mines where it has been installed. **(3)**



DEVELOPED for shortwall mining, the Dowty Rodjo shield provides an umbrella over the men and the machines. Dowty stresses reduced down time in setting the supports and high productivity as advantages of supported roof mining systems. **(5)**



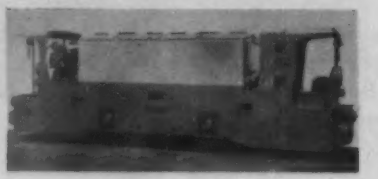
THE SUSPENDED idler structure that Meco—Mining Engineering Co. Ltd.—employs in their conveyor belt permits the empty belt to run a shallow trough, while the loaded belt troughs deeply through the patented idler design. Belt has remarkably undulation-free passage and spillage is largely eliminated. **(6)**



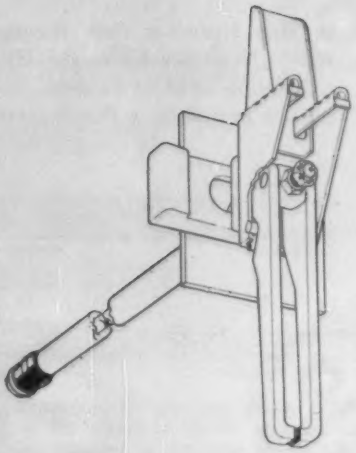
HYDRAULIC roof support system developed for shortwall mining by Dowty is called the Canopy and is designed much like the Roofmaster and the Rodjo shown nearby. **(4)**

Shawnee Mfg.—makers of attachments for wheeled tractors—has been purchased by Koehring Co. and will operate as part of Koehring's Parsons Div. which manufactures trenching and pipelaying equipment.

ROPE CHAINS and conveyor belting pallets are the keys to the G-Conveyor displayed by Glover Brothers (Mossley) Ltd. The G-Conveyor can be driven by sprocket wheels which engage with the rope chain couplers in the same manner as a plate chain, or by intermediate drives in the case of a long run of conveyor. No transfer points needed. **(8)**



GREENBAT 14-ton electric battery locomotive can be directed from either end, according to Greenwood & Batley Ltd. Normal drawbar pull is 4,000 lb at an on-the-level speed of 8 mph for one hour. The Greenbat is equipped with two 45-hp 200 v motors. **(9)**



PATENTED recoverable roof bolt has high holding power even in soft strata and can be re-used indefinitely. Bolt is 4½ ft long and of 1 11/16-in. steel. Synthetic rubber gripping head expands as the bolt is tightened to make close contact with the wall. Loads varying from 3 tons in soft clod to 10 tons in hard sandstone can be withstood. Dowty. **(2)**

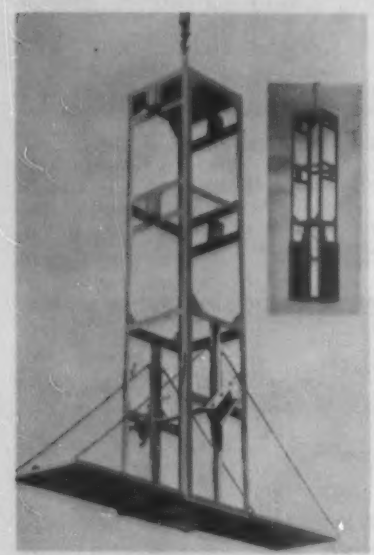
CONVEYOR loader, designed by W. G. Allen & Sons and called the Allen-Sotim Accumulator Car, incorporates a hopper in which muck can be accumulated while cars are being shifted and transferred. Car and conveyor are air operated. **(11)**

AN ELECTRIC rotary drilling rig—proved in a Lincolnshire iron mine—was shown by F. Taylor & Sons (Manchester) Ltd. Unit can be controlled by pushbutton and can drill to a height of 18 ft on a 24-ft face width from one setting of the carriage. Taylor states that up to 1500 ft of drilling has been done in about 6½ hours. Taylor also displayed roof-scaling carriage. **(10)**

An instalment sales plan has been started by Pettibone Mulliken Corp. to increase their sales of earthmoving equipment to the mining industry. Plan will offer extended terms to equipment buyers and will be administered by James Talcott, Inc., a Chicago finance institution.

Top Pivot Skip Door (12)

LAKE SHORE, INC. has come up with a front discharge skip with the same door-opening features of its Jeto skip. In some ways, the new unit is similar to the Anaconda and other front dumpers, except that the Lake Shore model pivots at the top. Rubber seal is forced against the door when it is closed and makes the unit water-tight. Clean, fast dumping operation are other features.

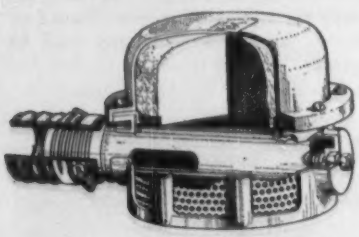


Timber Cage (15)

MACHINERY CENTER INC. announces the development and production of the Lance Timber Cage for shaft operations. The cage with sides down provides a large platform that permits easy mechanical surface loading of shaft and wall plate timbers. The Lance Timber Cage with sides folded transports timber.

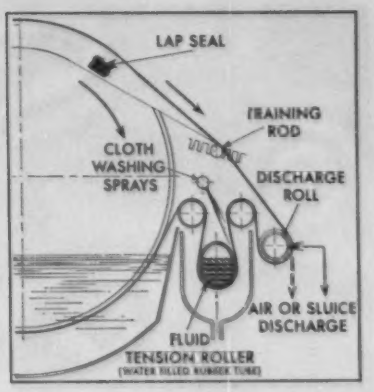
AN Loader (18)

SPENCER CHEMICAL CO. plans to market a pneumatic device for loading field-compounded ammonium nitrate explosives. According to H. R. Dinges, Spencer's vice president, Industrial Chemicals, the move was made to enable operators to combine the advantages of a low-cost explosive with fast, efficient hole loading.



Floating Suction Strainer (17)

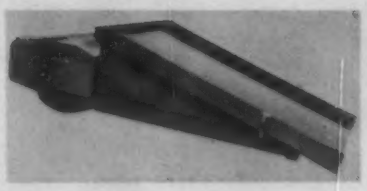
DEVELOPED and produced by Megator Pumps & Compressors, Inc., the Dolphin floating suction strainer meets a long-standing need for pump users drawing water from streams, ponds, underground or open-pit sumps. Dolphin reduces the tendency for the pump to suck air in with the water. Unit comes in four sizes for 1½-, 2-, 3-, and 4-in. hoses.



Patented Cloth Cleaner Prevents Blinding (34)

A DEVICE—the Cloth Discharger—has been patented and licenced to Peterson Filters & Engineering Co. that continually removes the filter cloth from the drum and washes it thoroughly before replacing it on the drum again. Result is that internal cloth blinding is eliminated and that pulps that form thin cakes can be filtered readily without blowback. Cloth life is extended because there is no scraping action.

Water is the key to the patented device and method. A fluid tension roller—a rubber tube filled with water—forms the tension arm that keeps the cloth in the proper track on and off the drum. Fluid Tension is very simple, but very sensitive—almost every string in the cloth is under the same tension. Photo above is from an operating unit in U.S. Potash Co. where the idea has been under test for the past two years, recovering brine from minus 325 mesh mud at elevated temperatures. Cloth washing solution can be kept separate, recycled or sent to waste. Cake is discharged just ahead of the washing step. Any type of cloth can be used. Peterson recommends a zipper fit for quick cloth replacement when required.



Vibrating Feeder (35)

SAID TO BE IDEAL for feeding large controlled tonnages—to 1,000 tph—from bins, hoppers to belts, crushers, pulverizers, kilns, grinding mills, scales and other processing equipment, the latest in the Jeffrey Mfg. Co. line of electric and mechanical feeders is now available. Heavy duty model No. 6-D is shown above with 60x90-in. open pan deck and renewable liner. Various deck styles are offered.

Pilot Remer Jig (39)

A PILOT PLANT size version of Western Machinery Co.'s Remer jig is available from Wemco. Unit is 1x3½-ft bed size and has a capacity of 1 to 3 tph depending on the size and type of feed. Wemco Remer jigs combine a conventional jig stroke with a separate high-frequency pulsation. Standard jigs from Wemco are available in sizes up to 5x16 ft.

Non-Blinding Screen (40)

A DECK comprised of free rolling loose steel rods which rotate as they vibrate can screen moist, sticky ores without blinding according to Allis-Chalmers Mfg. Co. The Inland loose deck can fit any A-C screen size. Rods are installed at right angles to the material flow and are accurately spaced and held by alloy steel spacers. Sizings down to ¼ in. are possible.

Push Button Drilling (13)

FINGER-TIP control of swinging, sliding, raising, lowering of the mast to any vertical, horizontal or angular position is possible with the new Thor Power Tool Co. No. TR-5 crawler rig. No. 140 4½-in. bore drifter is used.

Silconic Battery Plate (14)

GREATER battery performance at lower cost is the promise of Motive Power batteries from the Industrial Div. of Gould-National Batteries, Inc., according to recent statement on the new Silconic plate design. Gould has developed and patented a method for introducing arsenic and silver-cobalt sulphates into the positive plates which then form an oxide coating, preventing the most common of all battery failures—grid separation.

Brake By Exhaust (16)

AN UNUSUAL braking device employing the now-wasted power of the engine exhaust has been introduced by Power Brake Equipment Co. and has been in service on western truck routes for some time. Massive payloads can be decelerated smoothly and rapidly, and the development can help abolish the driver's terror—the runaway truck that has lost its air brakes. Braking device also is suitable for stopping cranes, mine equipment, etc. Stainless steel braking unit is installed on the engine manifold to use the exhaust and as long as the engine runs, the brakes have pressure with which to operate.

United Electric Coal Co. has purchased a second giant stripping shovel—a 45-yd Bucyrus-Erie Model 1050-B—for their Banner coal property near Peoria, Ill.

Portable Secondary Crusher (41)

WORLD'S largest secondary crusher for portable use is the claim made for the 60x30-in. Lippman Engineering Works, Inc. roll crusher built for a Texas firm. The plant can produce 5,000 cu yd of material a day—has hit as high as 7575 tpd. Secondary plant pictured above uses a 36x50-in. feed conveyor; a 60x30-in. roll crusher; a 5x14-ft triple-deck screen and two 2x12-ft reject conveyors.

Crushing-Screening Plant (42)

FIELD-TESTED crushing and screening plant has been announced by Iowa Mfg. Co. Plant is the Cedarapids Super Commander Tandem with a capacity up to 500 tph of 1 to 4 product sizes. Plant uses a 12x36-in. twin jaw crusher; 4x14-ft horizontal triple-deck vibrating screen and 36-in. conveyors.

Gas Mask Facepiece (43)

CALLED the M-S-A Clearvue, the facepiece above features a large single lens which is readily replaceable and designed to eliminate fogging. The facepiece has an improved speaking diaphragm and an accommodation for prescription glasses according to Mine Safety Appliances Co.

Dow Chemical has opened a sales office in South Africa to promote the complete company line of chemicals and products.

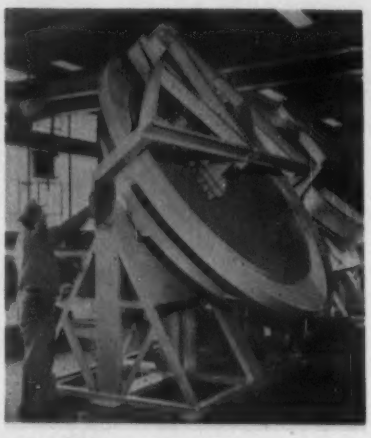
High Intensity Magnet (44)

RECENTLY developed high-intensity induced roll magnetic separator offered by Dings Magnetic Separator Co. is designed so that new pole nose contour provides graduated intensity through 37½ deg of rotor arc. Increased flux intensity through new magnetic circuit, vernier dial to accurately set splitters, and self-aligning sealed anti-friction bearings are other features. Type H separator is manufactured in widths from 2 to 30 in. with from one to seven rotors. Capacities of up to 800 lb per inch of rotor width per hour are possible.

Rubber Sheeting (45)

ABRASION resistant, adhesive rubber sheeting for do-it-yourself covering of chutes, launders and bins is announced by B. F. Goodrich Industrial Products Co. Known as Armorline, the material can be applied to metal, concrete, or wood. Armorline comes in rolls 50 or 75 ft long and 48 in. wide. Gages available are 1/16, ⅛ and ¼ in.

A gravel contractor in Minnesota switched engines in one of his 10-yd dump trucks from gasoline to diesel and the first 500 hours of service has other operators in the area thinking along the same lines, according to International Harvester. Diesel engine operates on one-half as much fuel as the engine it replaced and two-thirds as much as some of the V-type gasoline engines in the operator's other trucks. Diesel engine is a GM 4-53. Truck is an I-H 180 (1957).



Pelletizing Disk (46)

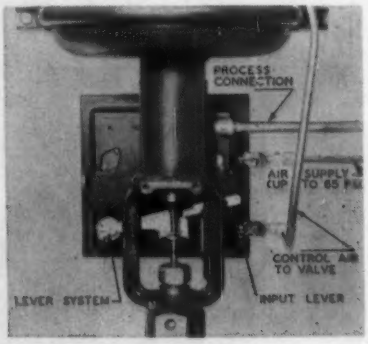
FOUR basic sizes of the Dravo Corp. pelletizing disk are available—39-in., 8½-ft, 12-ft and 16½-ft dia. The smallest size can be rented for short term pilot plant studies. Pelletizer was developed by Lurgi Co., Frankfurt, Germany and has been licensed to Dravo.

Alumina Ramming Mix (49)

ALURAM is an 85% alumina ramming mix developed by Refractories Div., H. K. Porter Company, Inc. and is recommended for lower sidewalls and bottoms of aluminum smelting and holding furnaces because of its high resistance to penetration by molten aluminum and slags.

Torsion Balance (47)

WEIGHINGS can be made in ⅓ of the time with the dial balance manufactured by Torsion Balance Co., according to a recent release. New design features a simple graduated dial which can be turned without arresting the oil-dampened balance. Dial is unconditionally guaranteed and is graduated from zero to 10 grams in one-tenth gram graduations. Dial is readable to 0.02 gram.



Controls, Positions Valve (48)

BELIEVED to be a first on the market, a new two-in-one instrument from United States Guage Div., American Machine & Metals, Inc. combines in one valve-mounted unit an indicating pneumatic controller for temperature or pressure and a valve positioner. Called the Pilot-Positioner, the instrument minimizes transmission lags and can be mounted on most makes of diaphragm valves. It requires only an air supply.

Hammermill Crusher (50)

THE LARGEST HAMMERMILL ever built by Iowa Mfg. Co. in the Cedarapids line has been announced as Model 5041—40-in. hammer arc and 50-in. feed opening. Size of product (down to 1 in.) depends on grate and hammer size.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

COMPRESSED AIR FUNDAMENTALS is the title of a 15-page bulletin (1548) prepared by Ingersoll-Rand for air-cooled compressors, ½ through 20 hp. **(51)**

OFF-HIGHWAY transportation equipment in the Easton Car & Construction Co. line is presented in a seven-page catalog (A). **(52)**

FORK LIFT trucks in the Allis-Chalmers Mfg. Co. line are detailed in a 15-page bulletin (BU-451A). **(53)**

EARTHMOVERS—the International Harvester 495 Payscraper and 495 Paywagon—are illustrated in a 36-page bulletin (CR-603-1). **(54)**

CUT YOUR TRACTOR COSTS is the title of a 16-page release published by LeTourneau Westinghouse on the L-W 218-hp Model C Tournatractor (TD-280). **(56)**

VARI-SPEED Motodrives catalog (M-592) from Reeves Pulley Co. explains the wide assortment of styles and accessories available from the company in the ¼- through 40-hp range. **(57)**

DOUBLE IMPELLER impact breakers in the Cedarapids line by Iowa Mfg. Co. are displayed in an 11-page bulletin (D-1). **(58)**

PARA-FLEX—the Dodge Mfg. Corp. flexible cushion coupling—is discussed in a 12-page bulletin (A669C). **(59)**

STEEL HAIRS for the office is the subject of a 20-page bulletin (FF-229-1) published by Remington Rand. **(60)**

SHAFT MOUNTED speed reducers in the Jones line from Hewitt-Robins are cataloged in a 23-page bulletin (J-19). **(161)**

THE CHEMISTRY OF THE FATTY ACIDS is the title of a 32-page revised booklet prepared by Armour Industrial Chemicals Co. Armour's 30 fatty acids are covered. **(62)**

ELECTROMAGNETIC pulleys to remove tramp iron from mill feed or products are discussed in Stearns Magnetic Products bulletin (1011). 8pp. **(63)**

CONFIRMATION of the third theory by Fred Bond—a paper presented at the 1959 annual AIME meeting—is available from Allis-Chalmers Mfg. Co. 15pp. **(64)**

COARSE and fine crushing, and Telsmith Gyraspheres (24-, 36-, 48- and the new 66-in. sizes) are discussed in Smith Engineering Works bulletin (274). **(65)**

THE GYRA-SAN process for scrubbing sands and clays is discussed in literature available from Gyra San Co., Inc. **(66)**

INFRARED car thawing equipment is available from Fostoria Corp., according to an 8-page bulletin. **(67)**

THERMOCOUPLES from Leeds & Northrup Co. are cataloged in detail in an illustrated 50-page release (EN-S2). **(68)**

HANDBOOK of hydrostatic instruments prepared by Petrometer Corp. is a handy 88-page pocket-size informative aid to the engineer. Also contains data on the company line of instruments **(69)**

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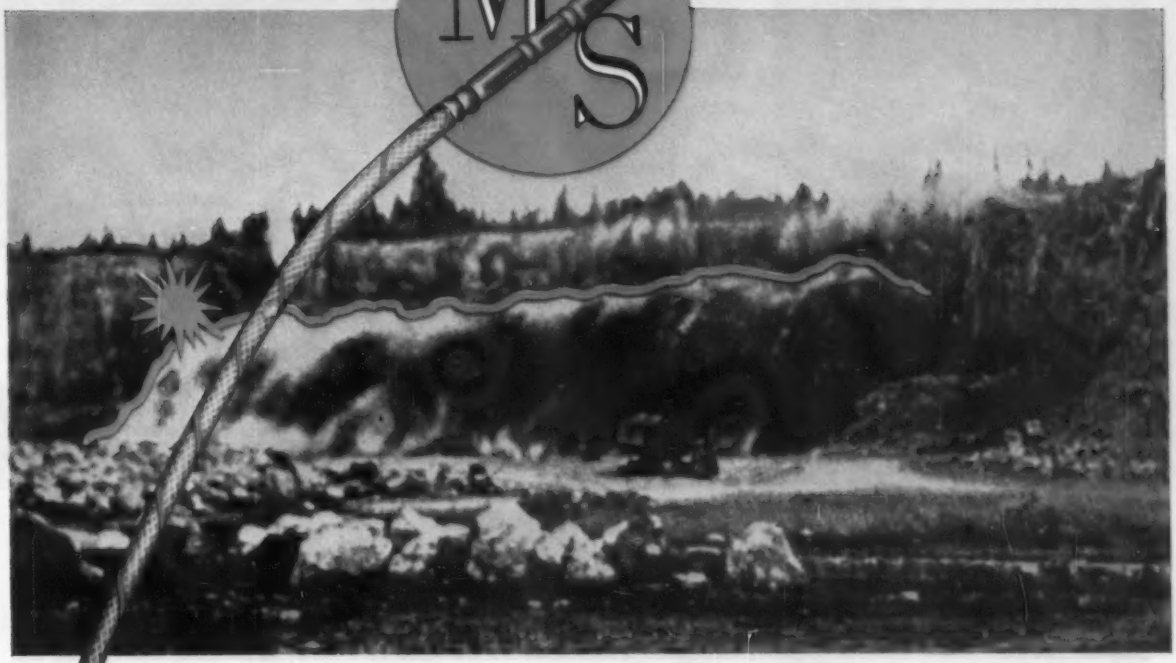
For Millisecond Delay Blasting

PRIMACORD® MS CONNECTORS*



are now available in three periods: 5, 9 and 17 MS

A Primacord MS Connector consists of a metal tube 2¾ inches long, containing an element that produces a delay measured in 5, 9 or 17 MS. A foot of Primacord is crimped in each end of the tube. The Primacord trunk line is cut between holes and the MS Connector joined to each of the two ends with a tight square knot, or lapped with pressure-sensitive tape. Packed 50 to a cardboard tube, 500 to a case.

16 mm movie film from which this enlargement was made.

This unretouched photograph was enlarged from a 16 mm frame. It shows a multiple hole blast detonated with Primacord, and hooked up with Primacord MS Connectors in the trunk line. Note the steady progress of this blast from the point of initiation at the left, as indicated by the red line.

Millisecond detonation of Primacord down lines in medium size holes offers many advantages in multiple hole blasting. Millisecond delay relieves burden, results in improved fragmentation. Less explosive may be required than for comparable instantaneous blasting. Decreased vibration and concussion, controlled throw and reduction of bootlegs are other advantages.

Under certain conditions the danger of cut-off holes can be minimized when Primacord MS Connectors are used on the order of 5, 9 or 17 milliseconds. In any event, the presence of unexploded powder in the muck is less hazardous when Primacord is the detonating agent. It cannot be set off by stray electrical currents, sparks, or ordinary shock, but must be detonated with fuse and cap or electric blasting cap.

For more information see your explosives supplier or write to

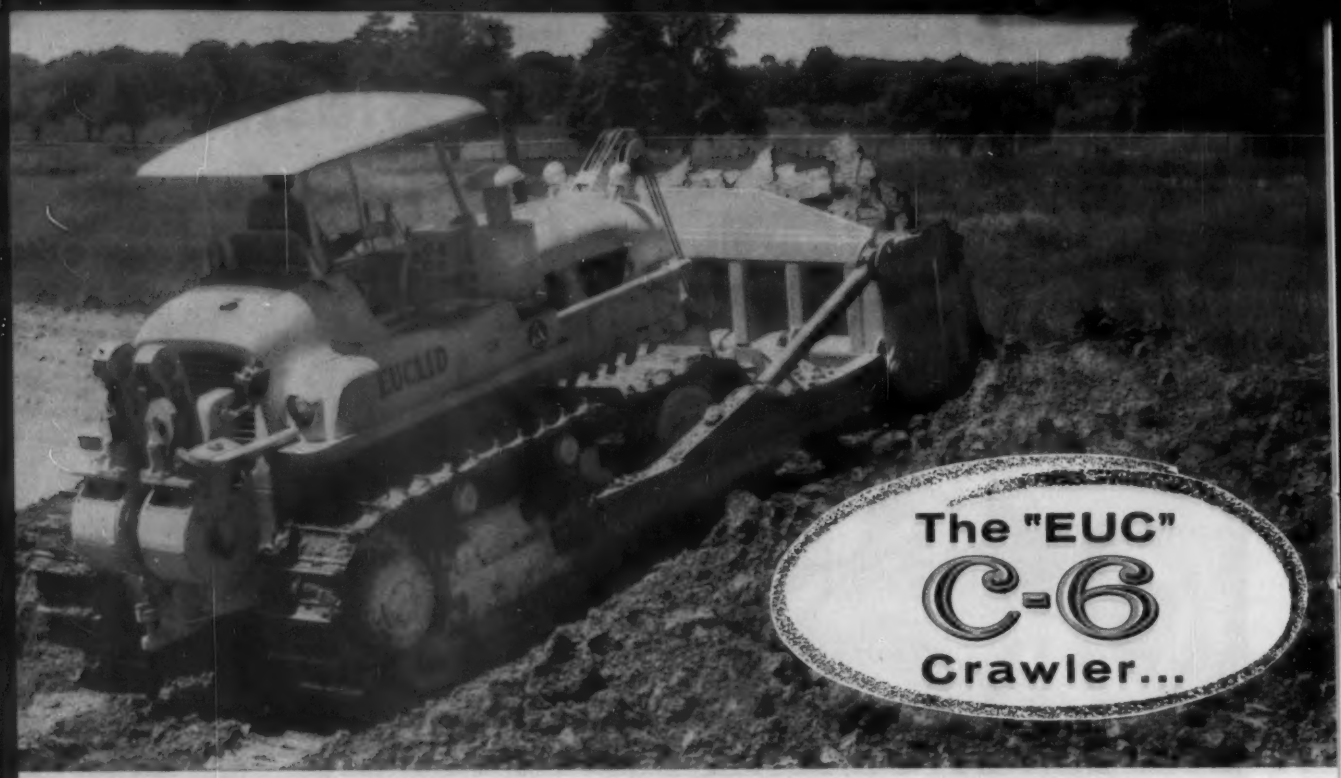
*Manufactured by E. I. duPont de Nemours & Company. Available through explosives suppliers

MS-1

THE ENSIGN-BICKFORD COMPANY

Simsbury, Connecticut • Since 1836

Safety Fuse, Primacord® and Detacord® Detonating Fuse, Ignitacord®, Quarrycord®, Pyrotechnical Devices and Blasting Accessories



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Here are just a few of the many features that put this new C-6 "Euc" years ahead of competitive crawlers:

Proven Torqmatic Drive . . . performance tested and proved in thousands of Euclid earth-movers on the toughest jobs.

Full Power Shift . . . no master clutch . . . easy operation and "fast as a fox" maneuverability that cuts work cycle time.

Fast, Positive Response . . . common steering and braking control, plus Torqmatic Drive for smooth operation on all tractor work.

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Low Maintenance Costs . . . easy accessibility of major components . . . no adjustment of steering clutches and brakes required . . . fewer lube points . . . dry type air cleaner . . . 7 track rollers . . . no tractor weight on final drives . . . recoil system eliminates mechanical springs.

No other Euclid product has ever had the thorough testing —both on proving grounds and on actual jobs—that the C-6 tractor has undergone during the last 5 years. All of the product refinements and improvements resulting from this exhaustive test program, plus Euclid's really new concept of crawler design, make C-6 performance a new standard for comparison in the 200 h.p. tractor class.

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FOR MOVING EARTH, ROCK, COAL AND ORE

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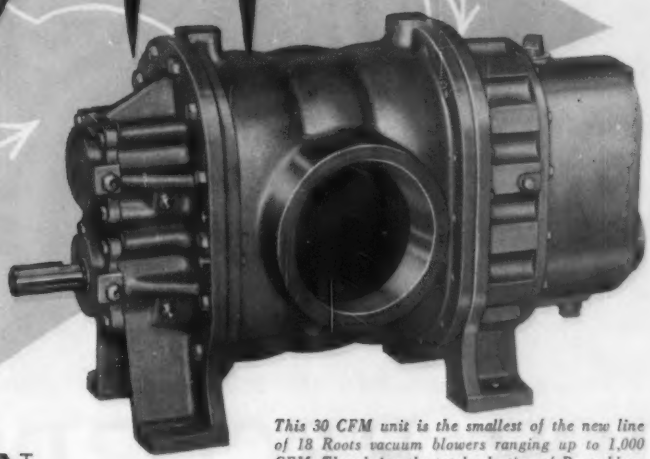
for efficient vacuum service as low as 30 CFM...



This 30 CFM unit is the smallest of the new line of 18 Roots vacuum blowers ranging up to 1,000 CFM. They bring the total selection of Roots blowers to 54 sizes...with savings for you in every size.

A BIG SELECTION OF SMALL ROOTS VACUUM BLOWERS

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Only Roots-Connersville offers exclusive rotary positive design and such ease of installation in vacuum blowers of this size. They are now available for a wide variety of application in the food, chemical, petroleum, paper, sewage and industrial waste treatment, mining and other industries.

Your nearest Roots-Connersville sales engineer has full details on this new series of vacuum blowers. Or write for a specification sheet and for Bulletin VP-158 covering the larger units.

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DIVISION OF DRESSER INDUSTRIES, INC.
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Firestones move more payloads per tire!

Firestone off-the-highway tires lower earthmoving costs by cutting downtime and staying on the job longer! Every Firestone tire is built with Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires. Tough Firestone treads and sidewalls defy cuts in rubble and shale. And Firestone S/F (Shock-Fortified) nylon cord bodies withstand bruising shock and impact to deliver maximum tire life! Count on Firestone off-the-highway tires for new low costs-per-hour! See your Firestone Dealer or Store and ask about the full line of tubeless or tubed off-the-highway tires and Firestone on-the-job service.

Rock Grip Excavator Wide Base

Rock Grip Excavator

When ordering new equipment always specify Firestone tires—available tubeless or tubed.

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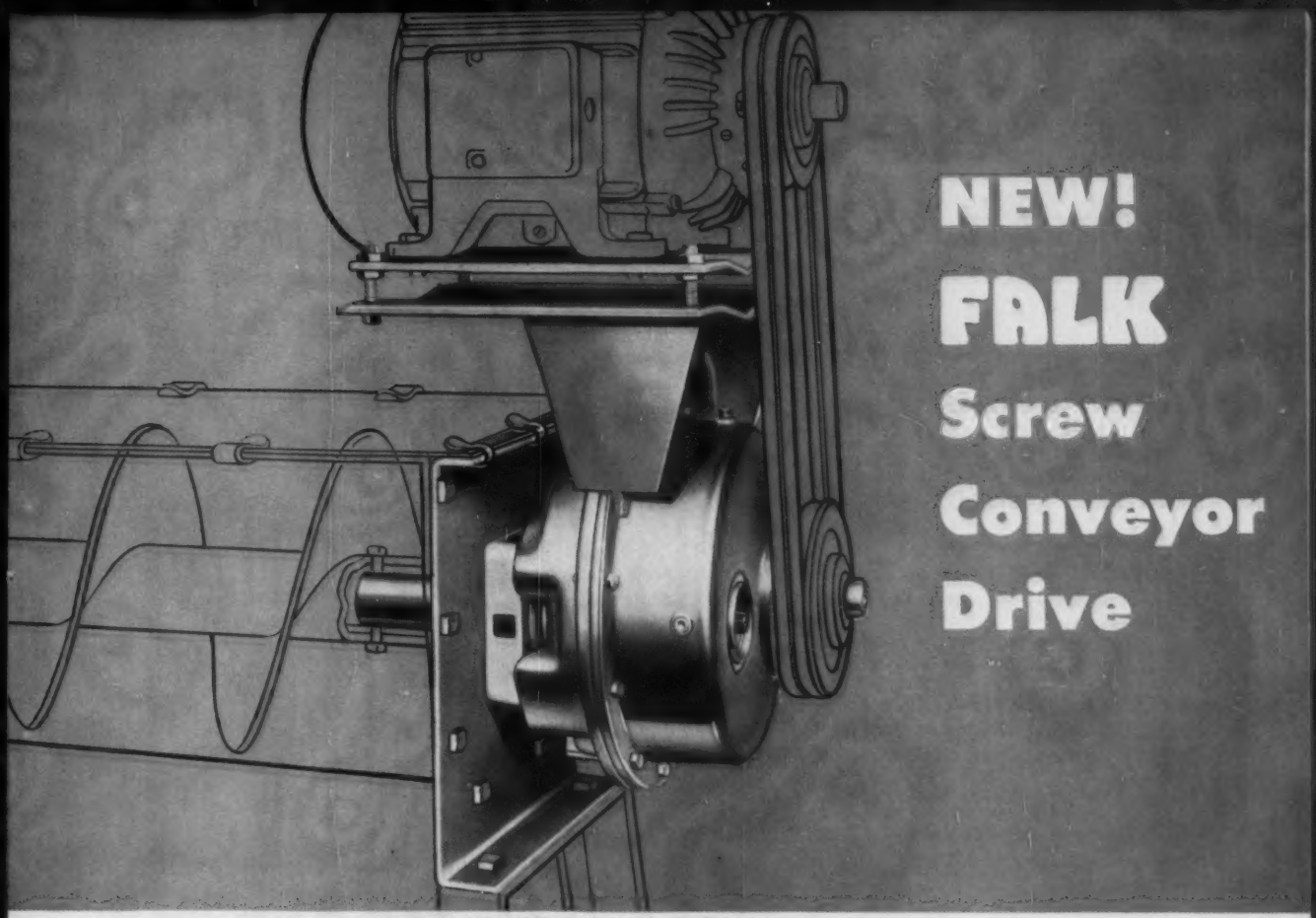

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U.S. and Foreign Patents Applied For

—the drive our customers asked for

Our customers helped us design this new unit. We sent our men into the field to find out what our customers needed in a screw conveyor drive—then our engineers designed a new drive that offers the maximum of service, versatility, operating economy and long life. Here are some of its outstanding features:

A COMPLETE DRIVE: Saves engineering and assembly time. Six sizes to cover entire range—each with these ratios: — 4:1, 9:1, 14:1 and 24:1. Bolts to any standard trough end—eliminates trough end bearing. Eliminates drive shaft wobble. Efficient FALK single helical gears.

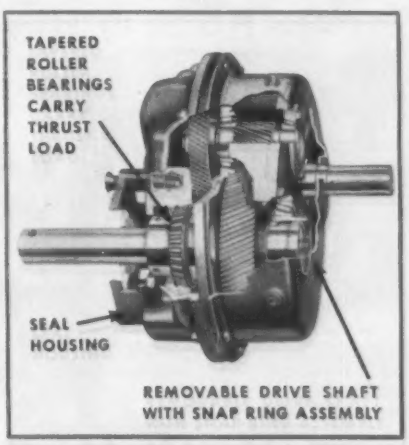
SEAL HOUSINGS: Choice of seals (neoprene or leather lip, felt or waste) to accommodate material conveyed. Space between trough seal and unit seal prevents conveyed material from reaching unit seal.

REMOVABLE DRIVE SHAFT: Snap ring assembly permits easy removal. Five sizes, from 1½" to 3 7/16".

TROUGH END: Can be fastened to any standard trough. Eight sizes, from 6" to 20".

ALL-STEEL MOTOR MOUNT: Saves costly engineering and installation time and costs; no motor plates to design or fabricate. Motor can be mounted in virtually any position. Pre-drilled to accommodate NEMA standard motors ½ to 30 HP.

AN IMPORTANT ECONOMY: Buy only what you need—the basic reducer alone, or with trough end and/or motor mount. For detailed information, contact your Falk Representative or Distributor—or ***write direct for Bulletin 7106.***



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MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

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...a good name in industry

The New 30-R

has what it takes—and is ready to prove it

Check the specs... check the performance... you'll find the new Bucyrus-Erie 30-R offers the same outstanding stamina, speed, and ease of operation that make the 40-R and 50-R the most popular blast hole drills in their classes — *by far.*

THE ADVANTAGES ARE ALL THERE — IN A NEW ECONOMY SIZE

Rock-Solid — and Twice as Tough — The 30-R levels instantly and stands firmly on three big hydraulic jacks... drills holes to 7⅞-in. diameter.

Drills Fast and Steady — Operates at any speed from 0 to 100 rpm. Drills continuously for more than 21 feet before adding new pipe. Exerts a maximum pull-down force of 30,000 pounds.

Self-Contained Convenience — Pipe rack carries five lengths of pipe — enough for a 100-ft hole.

Choice of Mountings — The 30-R may be mounted on crawler treads as shown, or on a truck. Truck-mounted models are offered with separate diesel engine or with chain-driven power take-off unit.

For further details write Bucyrus-Erie Company, Drill Division, P. O. Box 324, Richmond, Ind., Dept. 8BB.

BUCYRUS ERIE®

Builds Better Equipment

NOW! A REMOVABLE AIR-LEG BIT THAT'S ONE-PIECE STRONG

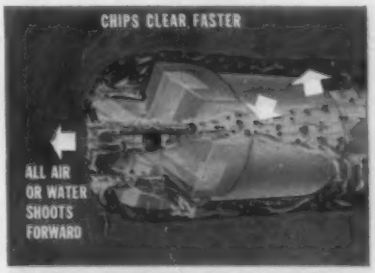
IT'S removable—yet the new Timken® tapered socket carbide insert bit for air-leg drills is one-piece strong. With this tapered union you get all the advantages of removability, and the strength of one-piece steel.

Removability of the new Timken tapered socket bit gives you all these advantages you can't get with intraset steels:

1) No need to throw away good drill steel when the carbides wear out. With intrasets you have to throw away good steels. 2) A pocketful of bits is enough for a day's work. You haul an armful of steel with intrasets. 3) You can change bit gauge sizes fast on the same steel. Using intrasets, you have to change the whole steel. 4) You carry only the bit to the shop for resharpening. With intrasets you lug the whole steel. 5) You get longer gauge wear because there are four carbide cutting edges. Most intrasets have only two.

The new Timken tapered bit's new frontal design features clear chips faster (right). And you get superior wear-resistance with added shock-resistance because of new special-analysis carbide inserts. They can be reconditioned many times.

To get removability *plus* strength, get the new Timken tapered bit. For free brochure, write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



CHIPS CLEAR FASTER because 1) five front holes shoot water or air directly against the rock face and 2) deeper, wider wing clearance lets chips wash back faster.

TIMKEN®

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THE AIR-LEG BIT OF THE FUTURE

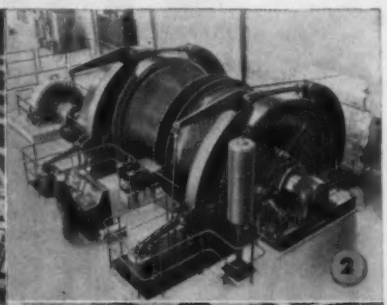
To Increase Production and Lower Operating Costs...Specify NORDBERG MINING MACHINERY

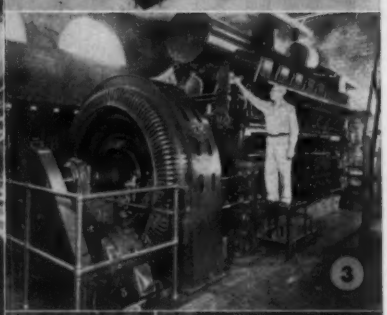
The complete line of heavy-duty Nordberg mining machinery includes Symons® Gyratory Crushers for primary breaking; Symons Cone Crushers for secondary and tertiary crushing; Grinding Mills; Symons Vibrating Grizzlies and Screens; Mine Hoists; and Nordberg Engines for mine and mill power.

Rugged, heavy duty construction of Nordberg mining machinery assures continuous production at low operating and maintenance costs.

Here is mining machinery that is used by the world's leading producers of ores and industrial minerals.

Write for complete information.





1 GRINDING MILLS . . . Ball, pebble, tube, rod and compartment types for wet or dry, open or closed circuit operation. Sizes to 13' diameter and up to 50' long.

2 NORDBERG ENGINES . . . From small power-units to large stationary plants, for Diesel, Duafuel®, and Spark-Ignition Gas operation, in sizes to over 11,000 horsepower.

3 MINE HOISTS . . . Built in conventional drum types as well as in friction types, for hoisting both ore and men, in a wide range of sizes to meet large coal and metal mining operations.

4 VIBRATING SCREENS and GRIZZLIES . . . In types and sizes to meet practically all requirements from heavy scalping to fine screening applications.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

NORDBERG

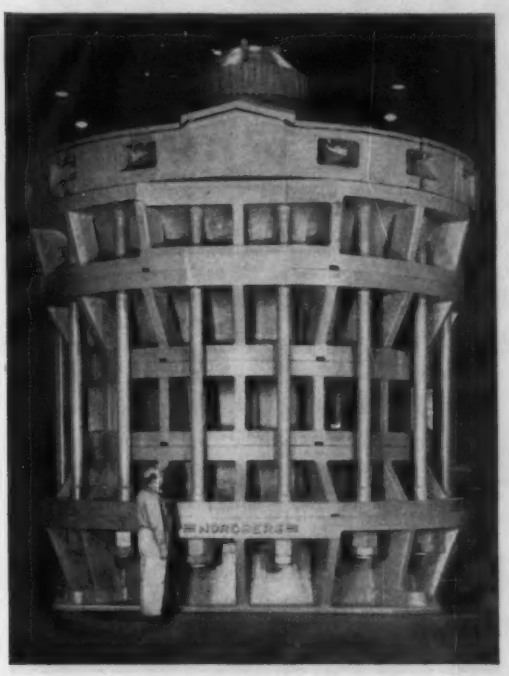
SYMONS . . . a registered Nordberg trademark known throughout the world.

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

SYMONS CONE CRUSHERS

Built in 11 different sizes, ranging from 22″ to 7′ dia., for capacities from 6 to 900 or more tons per hour.

(Illustrated at the right is a typical installation of Symons Cone Crushers and Rod Deck Screens serving a large Taconite Iron Ore producer).



SYMONS GYRATORY CRUSHERS

For heavy-duty primary breaking, available with feed opening sizes of 30″, 42″, 48″, 54″, 60″ and 72″, for capacities to 3,500 and more tons per hour.

©1958, N. M. Co.

M158

High Strength Welds for High Strength Steels . . .

T1 STEEL
N-A-X
JALTEN STEELS

YOLOY STEELS
JALLOY STEELS
REPUBLIC 50

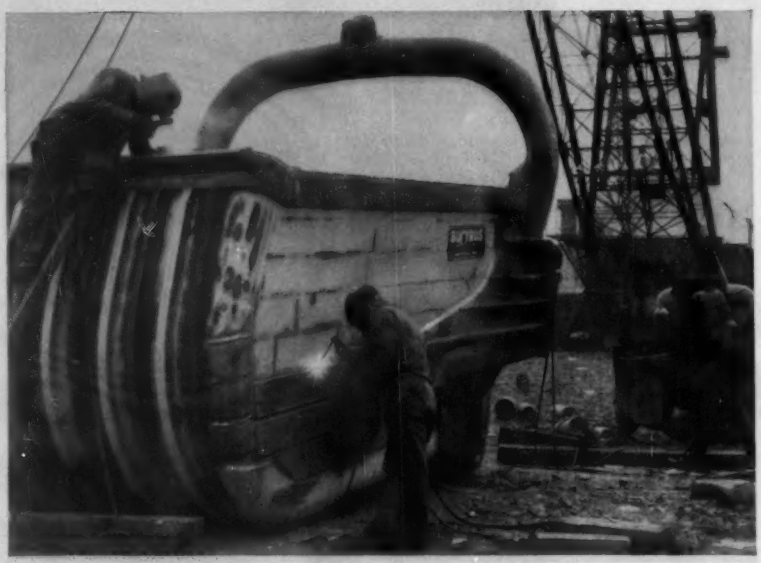
TRI-TEN
COR-TEN
USS A R STEEL

JALLOY #3 & #7
HI STEEL
SHEF-TEN

. . . Specify ATOM•ARC ALL POSITION IRON POWDER LOW HYDROGEN ELECTRODES

The very ruggedness and strength of your present equipment may be attributable to the X-ray sound, high strength welds of Atom•Arc electrodes. Quality conscious equipment builders rely on the full line of Atom•Arc electrodes for welding every type of low alloy high strength steel, constructional or abrasion resistant, from 70,000 p.s.i. to 120,000 p.s.i. tensile strengths. One of these Atom•Arc grades will provide welded joints with mechanical properties comparable to your base material.

Down time is costly in stripping operations and unnecessary when due to poor welds. Provide the same strength and ruggedness in your maintenance welding that was designed into your equipment originally . . . specify Atom•Arc all position iron powder low hydrogen electrodes.



The T1 steel being applied to the inner and outer surfaces of this 32 yard bucket will add greatly to its strength and life without adding unnecessary weight. The Welds must match the strength and other qualities of T1 steel, that's why Atom•Arc 'T' electrodes, designed especially for welding T1 steel, were used.

The faster welding speeds and ease of portability of the Wear-O-Matic Wire Feed Unit make possible regular maintenance work right in the pit. The operator above is applying nickel manganese weld metal to the bucket lip. The teeth will be sent to the shop for rebuilding. The modest $279.00 price tag on this unit has induced many maintenance men to purchase separate units for shop and field use.

You can lower your hard surfacing costs with the Wear-O-Matic Process. The Wear-O-Matic semi-automatic hard surfacing process offers you the most efficient, low cost method of rebuilding equipment parts subject to wear. Wear-O-Matic wires are available in seven different alloys, each designed for a specific function in combating the varied wear conditions encountered in stripping or underground mining operations.

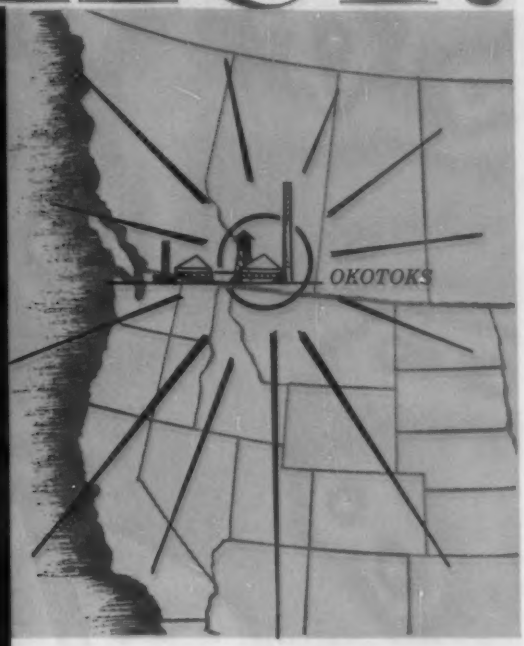
For better quality in your welding, and longer wearing, more economical hard surfacing write for the complete Alloy Rods package. Request Bulletin HS49. Alloy Rods Company, P. O. Box 1828, York, Pennsylvania.

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

SULPHUR

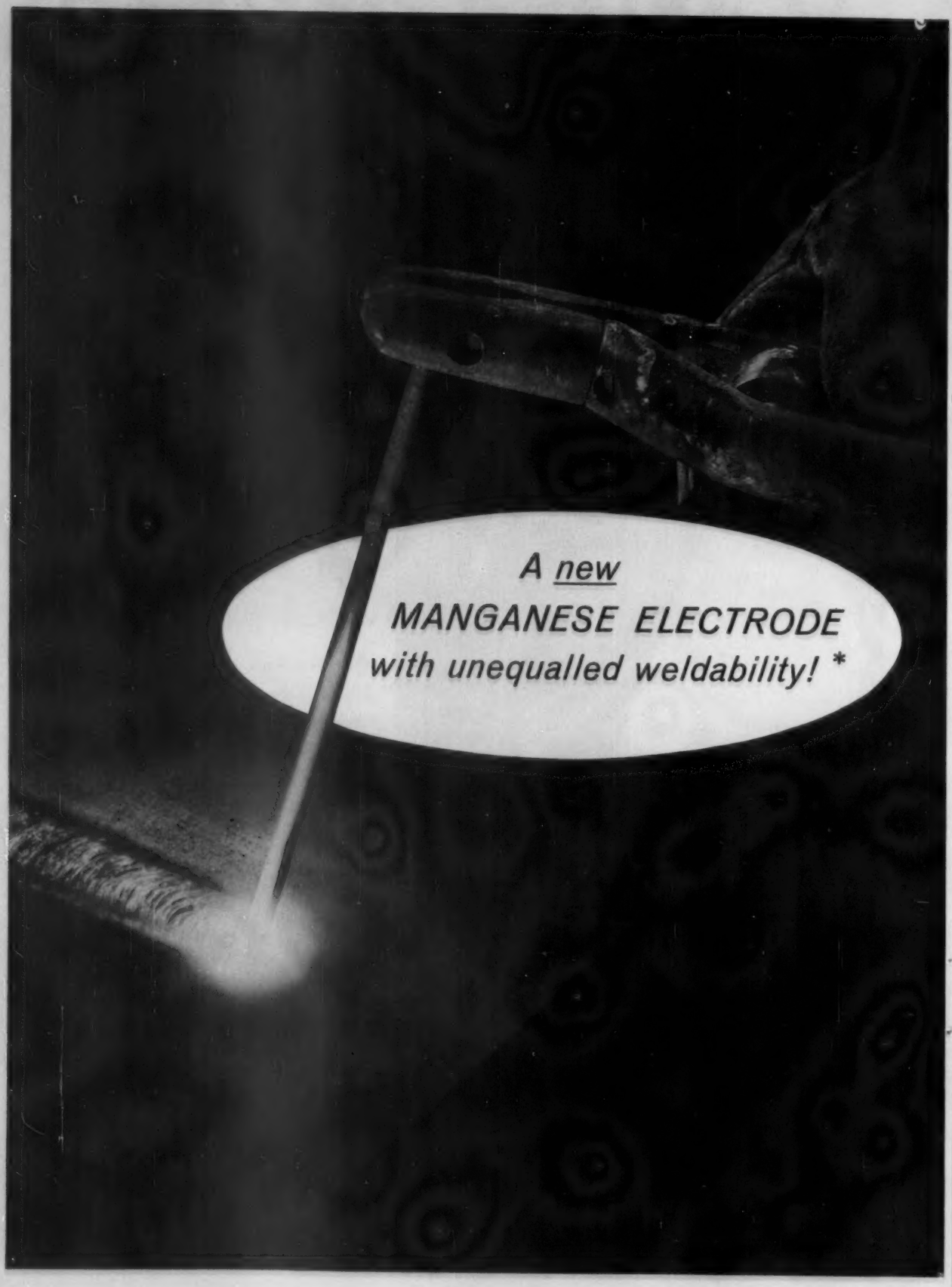
Spotlighting the new TGS Recovery Plant at OKOTOKS



OKOTOKS marks another step in the steadily broadening service being developed by TGS for industries in the States and Canada. Production from OKOTOKS, sitting on top of the vast "sour gas" field a few miles south of Calgary, Alberta, will add a significant tonnage to the supplies of Sulphur already available through TGS to the expanding industries in the Pacific Northwest. OKOTOKS is set up to make shipments of Sulphur in solid or molten form.

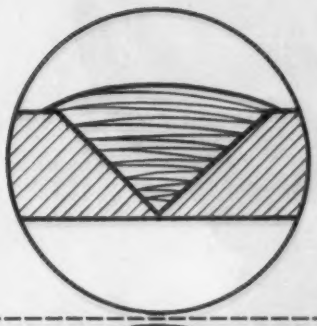
TEXAS GULF SULPHUR COMPANY
75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units:
Newgulf, Texas • Spindletop, Texas • Moss Bluff, Texas
Fannett, Texas • Worland, Wyoming
Okotoks, Alberta, Canada

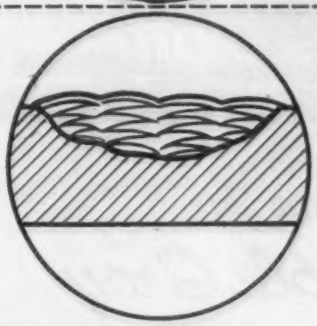

A new
MANGANESE ELECTRODE
with unequalled weldability! *

STOODY NICKEL MANGANESE

WITH IRON POWDER COATING



FOR JOINING



FOR BUILD-UP!

New Stoody Nickel Manganese electrodes solve manganese welding problems in the field or in the shop! You'll find it unexcelled for joining manganese parts or building up worn areas on manganese equipment. Stoody Manganese is now produced as a solid core wire on which the alloying elements in an iron powder coating are extruded. Unusual welding properties are obtained *with physicals unexcelled in the industry!*

FEATURES:

Stable arc – No popping	Freedom from cracks
Easy re-strike	No porosity
Fast deposition	Easy slag removal
Low spatter	Clean deposits

Cores are uniformly straight and coatings perfectly concentric—insuring a stable, smooth running arc.

Ask your Stoody Dealer for test samples... check speed and welding qualities, *test performance against every other manganese electrode you've ever used...* you'll find Stoody Nickel Manganese provides something *new* and *needed* in the industry!

PHYSICAL PROPERTIES:

(Based on tests by independent laboratory)

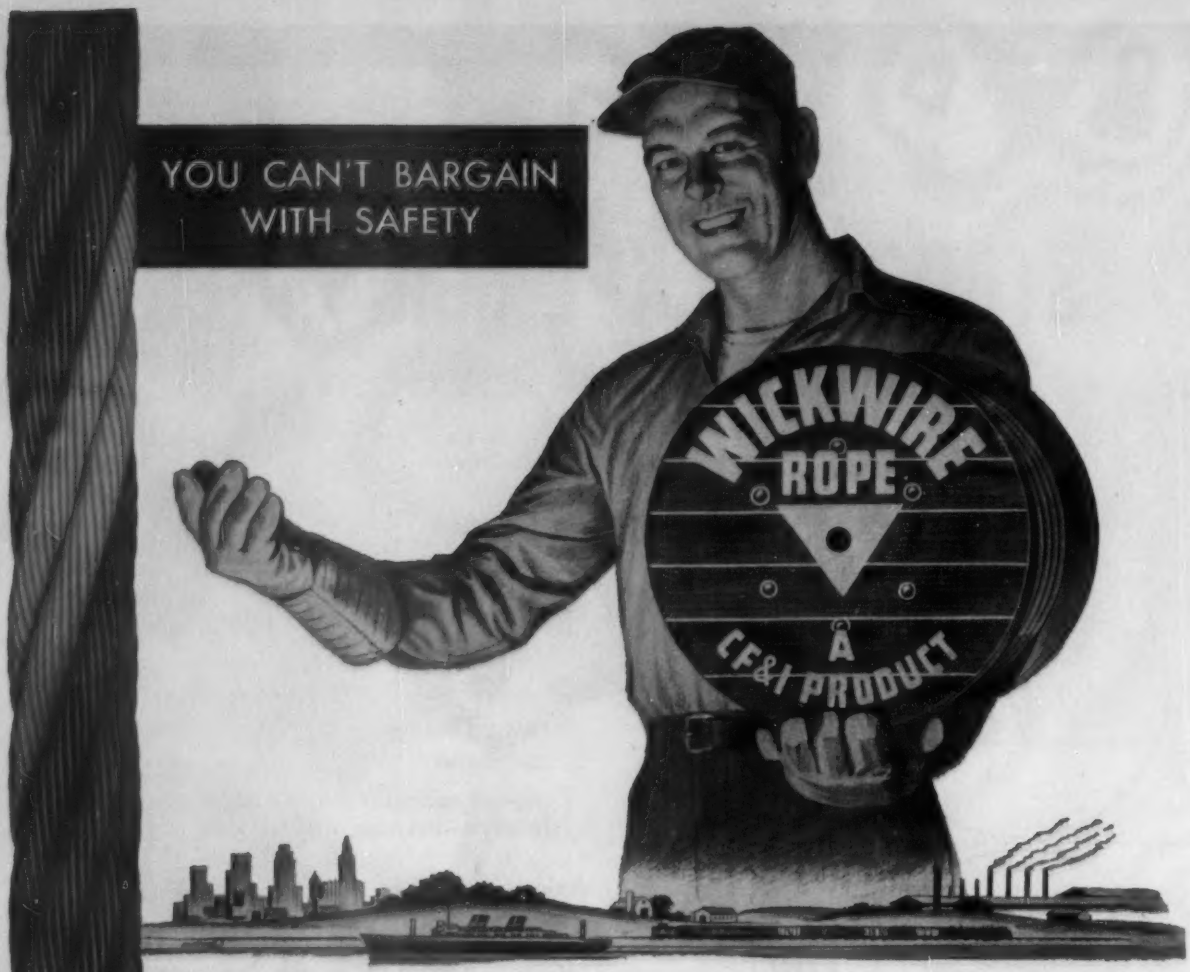
	DC Straight Polarity	DC Reverse Polarity
Tensile Strength	119,000 psi	111,000 psi
Yield Strength	67,000 psi	66,000 psi
Elongation in 2"	55%	37.5%

Hardness—Single pass on manganese steel;
as deposited—15 Rc, as work-hardened—48 Rc.
Two passes on manganese steel;
as deposited—18 Rc, as work-hardened—48 Rc.

*Be sure that your Maintenance Superintendent and Welding Foreman see this announcement!

Call your Stoody Dealer—check the Yellow Pages of your phone book or write for list of dealers serving your area.

STOODY COMPANY
11930 East Slauson Avenue
Whittier, California



For extra high strength wire rope...
use CF&I-Wickwire *Double Gray*

The CF&I Image reflects CF&I's experience as a producer of many steel products and CF&I's versatility in developing new products to meet exacting requirements . . . like Wickwire Double Gray*.

The special steel used in Double Gray provides extra resistance to the deforming effects of peening and crushing which occur on the drums and sheaves of heavy equipment. Double Gray also gives extra resistance to abrasion.

Because of these superior qualities, Double Gray rope quickly repays its slightly higher initial cost in safer, more economical operations. Use it wherever extra high strength wire rope is required.

For a free copy of our Double Gray booklet, write to: Advertising Department, The Colorado Fuel and Iron Corporation, 575 Madison Avenue, New York 22, N. Y.

**Wickwire Double Gray Wire Rope is made of extra-improved plow steel. Fortified by an independent wire rope core of the same extra high strength steel, Double Gray rope has a 15% higher breaking strength than the catalog breaking strength of an improved plow steel rope with IWRC.*

6632

WICKWIRE ROPE

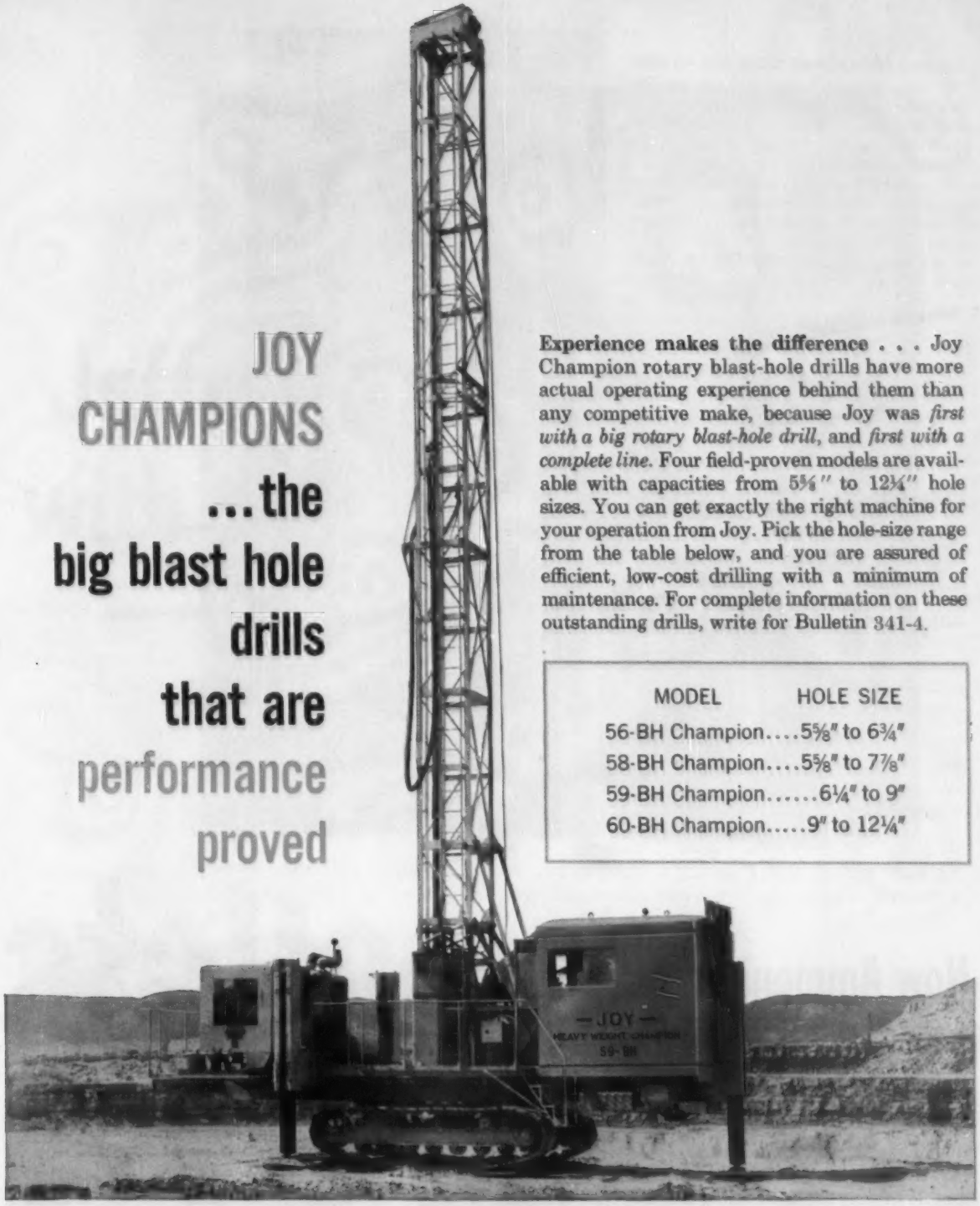
THE COLORADO FUEL AND IRON CORPORATION

In the West: THE COLORADO FUEL AND IRON CORPORATION—Albuquerque · Amarillo · Billings · Boise · Butte Denver · El Paso · Farmington (N.M.) · Fort Worth · Houston · Kansas City · Lincoln · Los Angeles · Oakland · Odessa (Tex.) Oklahoma City · Phoenix · Portland · Pueblo · Salt Lake City · San Francisco · San Leandro · Seattle · Spokane · Tulsa · Wichita

In the East: WICKWIRE SPENCER STEEL DIVISION—Boston · Buffalo · Chattanooga · Chicago · Detroit · Emlenton (Pa.) New Orleans · New York · Philadelphia

CF&I STEEL

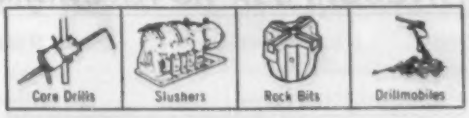
JOY CHAMPIONS ...the big blast hole drills that are performance proved



Experience makes the difference . . . Joy Champion rotary blast-hole drills have more actual operating experience behind them than any competitive make, because Joy was *first with a big rotary blast-hole drill*, and *first with a complete line*. Four field-proven models are available with capacities from 5⅝" to 12¼" hole sizes. You can get exactly the right machine for your operation from Joy. Pick the hole-size range from the table below, and you are assured of efficient, low-cost drilling with a minimum of maintenance. For complete information on these outstanding drills, write for Bulletin 341-4.

MODEL	HOLE SIZE
56-BH Champion	5⅝" to 6¾"
58-BH Champion	5⅝" to 7⅞"
59-BH Champion	6¼" to 9"
60-BH Champion	9" to 12¼"

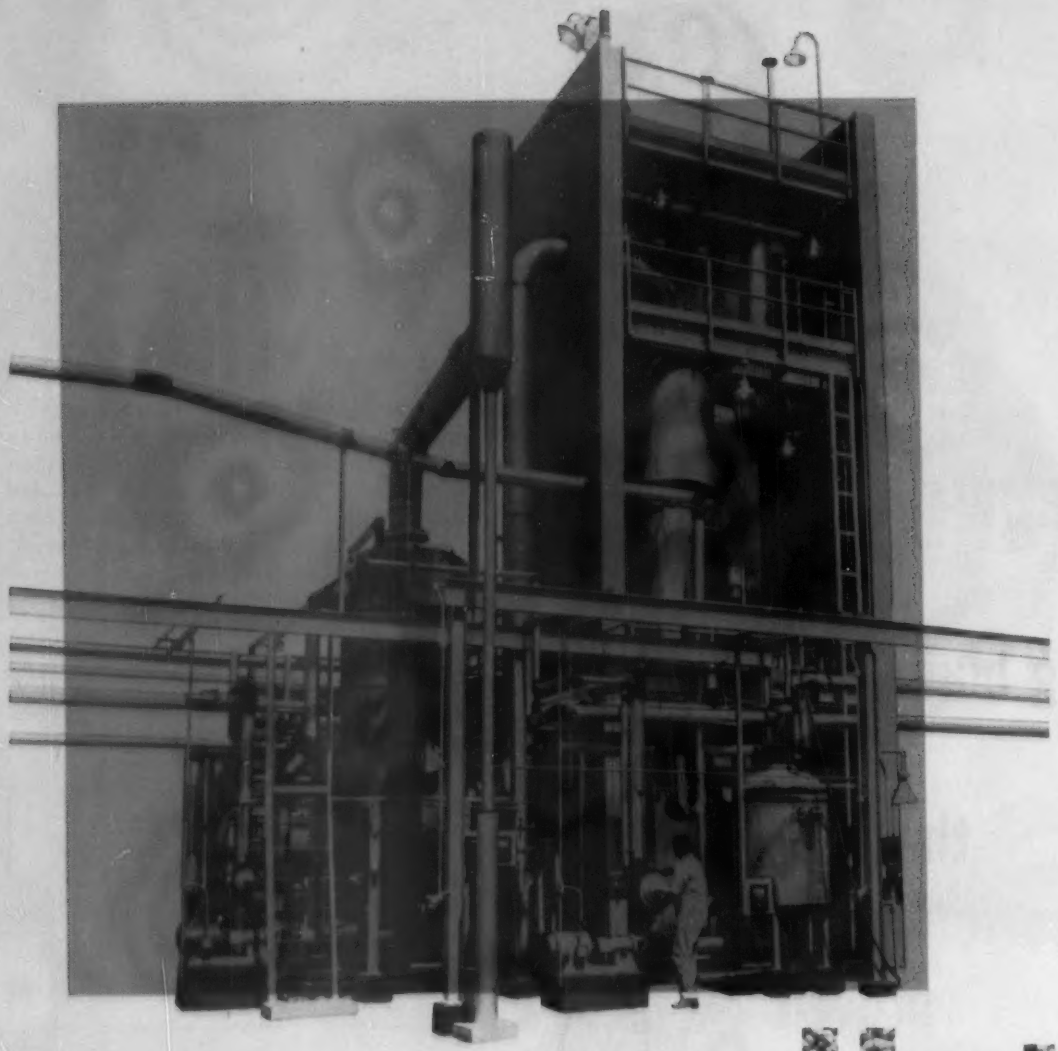
EQUIPMENT FOR MINING... FOR ALL INDUSTRY



JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario



Now Ammonium Nitrate in pellets

New $5,000,000 Atlas Plant
Produces Unique, Improved Blasting Agent

Atlas is now producing low cost Ammonium Nitrate in a new pelleted form designed especially for blasting. Atlas Pellets give oil absorption equal to prills, and flow freely for fast loading into all types of blast holes. The new blasting agent is being made in the new $5 million Atlas acid and ammonium nitrate plant near Joplin, Mo.

Not a granule, not a prill, Atlas Pellets are porous but compact particles which, when oiled, have both the density and sensitivity required for efficient low cost ammonium nitrate blasting. They are the latest advance in developing new products and techniques to help the user of explosives gain lowest possible blasting costs. Your Atlas representative can help you put these products and techniques to profitable use in your operation.

EXPLOSIVES DIVISION
ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE
Offices in principal cities

"ONE OF THE MOST IMPORTANT QUALIFICATIONS for Jeffrey sales engineers," says W. G. Montgomery, District Manager at Bluefield, West Virginia, "is a keen power of observation. Thus he builds up experience that is invaluable to his customers." Montgomery is shown at Omar Mining Company, Omar, West Virginia, where Jeffrey recently system-engineered all cutting and loading equipment for Mine 15. The first new unit in service (cutter, loader and 2 shuttle cars per unit) has delivered 677 tons of clean coal per shift. Drift mine height is 39" to 56".

Jeffrey Service starts with system engineering

When you discuss your mining machinery requirements with Jeffrey, you will work with an experienced sales engineer.

He not only knows the ability of his equipment but knows coal mining, too. Years of experience with all kinds of mining conditions have made him adaptable . . . given him the know-how to help you achieve low cost production.

Thus the Jeffrey sales engineer studies your mining problem thoroughly. For example, a recent proposal for the mine of a major coal company included a complete study of the seam conditions and mining projection—indicating production, personnel requirements, predicted costs and equipment to do the job. This kind of system engineering pays off for the purchaser.

Give Jeffrey's complete service an opportunity to work for you. *You'll find it pays off in predictable results.* The Jeffrey Manufacturing Company, 974 North Fourth Street, Columbus 16, Ohio.

OFFICES: Birmingham, Alabama; Bluefield, West Virginia; Denver, Colorado; Evansville, Indiana; Harlan, Kentucky; Iron Mountain, Michigan; Los Angeles, California; Pittsburgh, Pennsylvania; Salt Lake City, Utah.

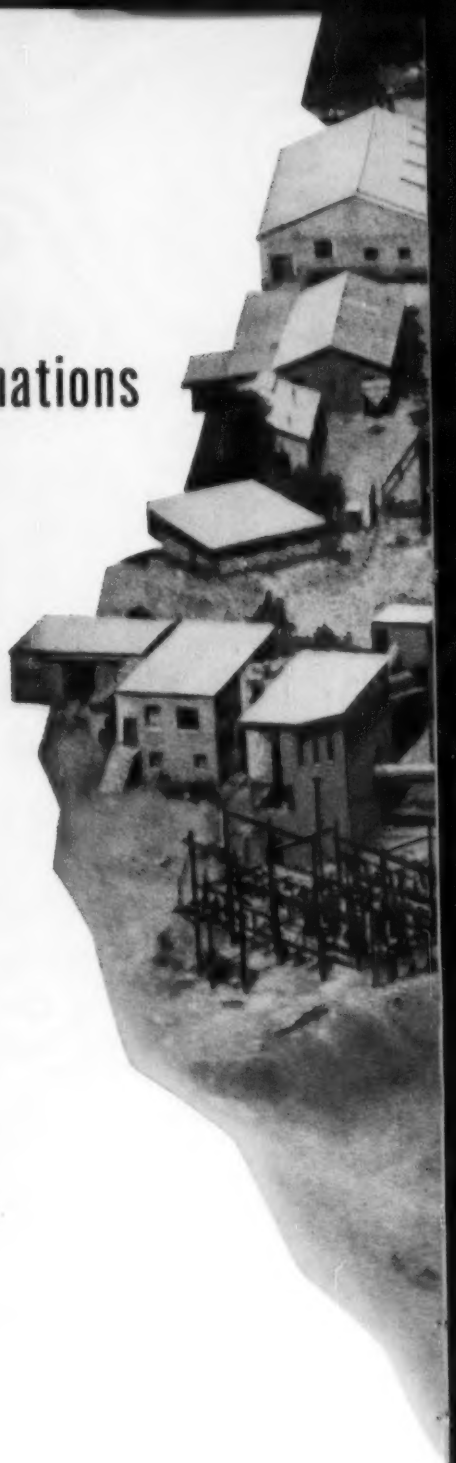
JEFFREY TEAM ON THE JOB—System engineering gets follow through from an experienced team as new equipment goes into service. Shown are Montgomery; Sales Engineer P. M. Campbell; Application Engineer D. R. Ellis; Serviceman W. C. Mayo; Chief Demonstrator R. W. Ramer; Demonstrator L. Damron.

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

SHATTUCK DENN

offsets rising costs with improved Cyanamid Reagent Combinations



At its Humboldt, Arizona Iron King Mill, Shattuck Denn Mining Corporation treats 1000 tpd of a complex, fine-grained sulfide ore by flotation and cyanidation to recover lead, zinc, gold and silver plus a small amount of copper. While this is primarily a lead-zinc operation, recovery of gold occurring in the pyrite and silver occurring in tennantite is important to profitable operation. Heads average about 50% pyrite, and contain 8-9% Zn, 2.5-3% Pb, in addition to gold and silver values.

In 1942 Shattuck Denn evolved an "index of economic recovery" for evaluating daily metallurgical results from five pay metals recovered with two differential flotation operations and subsequent cyanidation of the flotation tails with AERO® Brand Cyanide. The index compares actual returns with the theoretical maximum dollar return based on current metal prices, freight and treatment charges.

Rising costs have compelled constant study and revision of reagent combinations. But, because of improved metallurgy and milling equipment, zinc economic return now exceeds the theoretical maximum economic recovery. Recently, reagent changes again improved metallurgy and dollar return, as reported by the Cyanamid Field Engineer working on the job with Shattuck-Denn metallurgists:

"SODIUM AEROFLOAT® Promoter has replaced potassium ethyl xanthate in the zinc circuit. AEROFLOAT® 208 Promoter, AERO® Xanthate 301 and AERO® Depressant 620 have replaced AERO® Promoter 404 and potassium ethyl xanthate in the lead circuit."

"As a result, the economic recovery index for the first six months of 1959 is 12.3% better than the figure for the year 1956. Particularly noteworthy is a 26% increase in economic recovery in the zinc circuit, due primarily to the use of SODIUM AEROFLOAT Promoter. Reagent changes in the lead circuit have also improved lead concentrate grade and lead recovery."

An important part of the extra value received by users and prospective users of Cyanamid reagents are the services of Cyanamid Field Engineers backed by the Cyanamid Mining Chemicals Laboratory. The nearest Cyanamid Field Engineer will be glad to work with you in using Cyanamid reagents to help you try to cut costs and improve metallurgy.

REAGENTS, LB/TON, PRESENT

Ball Mill		Pb Circuit		Zn Circuit	
AERO Brand Cyanide	0.73	AERO Xanthate 301	0.05	CaO	2.2
$ZnSO_4$	0.88	Cresylic Acid	0.01	$CuSO_4$	2.1
AEROFLOAT 208	0.05	AERO Depressant 620	0.015	SODIUM AEROFLOAT	0.18
				Cresylic Acid	0.02

REAGENTS, LB/TON, PREVIOUS

Ball Mill		Pb Circuit		Zn Circuit	
AERO Brand Cyanide	0.62	K Ethyl Xanthate	0.02	CaO	2.3
$ZnSO_4$	0.79	Cresylic Acid	0.05	$CuSO_4$	2.4
AERO Promoter 404	0.04	Methyl Isobutyl Carbinol	0.04	K Ethyl Xanthate	0.25
				Cresylic Acid	0.01

RESULTS

	Present, 6 mos. 1959	Previous Year 1956
Overall Economic Recovery	83	70.7
Zinc Economic Recovery	100	74
Pb Concentrate, % Pb	32.8	26.4
Zn Concentrate, % Zn	56.3	50.4

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID

CYANAMID INTERNATIONAL—*Mining Chemicals Department*
Cable Address:—Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Looking for a modern 2½ yd. shovel?

CHECK THESE MODERN FEATURES

- ✔ Disc type clutches
- ✔ Forced air cooling
- ✔ Multi-Stage Torque Converter
- ✔ Exclusive Powerflo slide pinion
- ✔ Simplicity of design . . . only 14 gears and pinions
- ✔ Simple jack adjustment of crawler treads
- ✔ Dependable air or manual controls
- ✔ Self-removing counterweight
- ✔ Convertible to crane, dragline and trench hoe

SEE THE *NEW* MANITOWOC MODEL 3100

IN PERFORMANCE

IN OUTPUT

Here is a new Manitowoc shovel in the 2½ yd. range that will outproduce and outperform anything in its class. Completely modern in design, the Model 3100 provides many exclusive, advanced features that contribute to more yardage per shift at lower net cost per yard.

Though it's a big machine, with all the big machine design and construction features, the Model 3100 handles, travels and can be moved from job to job with small machine ease. It's easy to make fast, short moves by truck because a minimum number of rugged, precisely machined fittings allow you to remove the counterweight, *complete* crawler assemblies and other components without time consuming advance preparation and effort . . . *and* the 3100's overall maximum outside width of only 11'1" (within ordinary RR shipping clearances) means you can run it aboard a standard flat car, as is, and you're ready to go!

The Manitowoc 3100 is a big producer and big earner on any job—shovel, crane, back hoe, clam or dragline. Ask your Manitowoc distributor for additional details and specifications on the new Manitowoc Model 3100 . . . a really modern 2½ yard excavator.

Manitowoc

MANITOWOC ENGINEERING CORP.

(A subsidiary of The Manitowoc Company, Inc.)

MANITOWOC, WISCONSIN

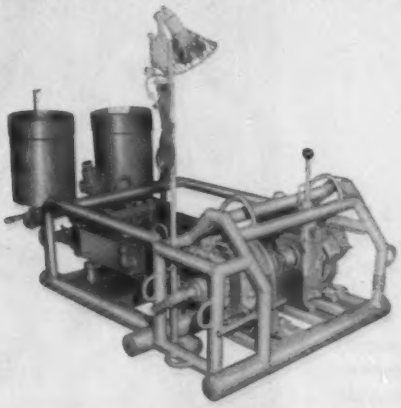
CRANES	SHOVELS	DRAGLINES	TRENCH HOES
25 TON - 100 TON	1¼-YD. - 5½-YD.	1¼-YD. - 6-YD.	1¼-YD. - 3-YD.

HALLIBURTON

GROUTING

SERVICES

complete equipment, men, and materials for any size grouting job!



THE HALLIBURTON METHOD of grouting dating back to 1930, has attained an outstanding performance record due to a constant and continued scientific research and development program in the field of grouting techniques. Through improved grouting methods, Halliburton has pressure-grouted many million sacks of portland cement and special grouting chemicals.

Halliburton's successful pressure grouting record is due to its experienced grouting engineering service personnel and the latest scientific grouting developments within its own technical, development laboratory... having continuously created grouting materials and developed grouting equipment that are unique for improved grouting operations.

The Halliburton Pressure Grouting method offers some of these exclusive features:

- A dependable and convenient method of metering, mixing and placing grouting materials – continuously.
- A Grouting Pump Assembly... consists of skid mounted pump units incorporating all the pump equipment, calibrated tanks, manifolding, pressure gauge, pressure recorder, hoses and mixing jet gun.
- Pump Unit is either air motor or diesel engine driven... to conform with the availability of compressed air on the job site.
- Power Units are demountable in order to reduce size and weight of component parts for easier handling and transporting in such areas as restricted mine passages and shafts.
- Pressure gauge permits accurate control of grouting material discharge.
- Pressure recorder produces a time-pressure chart of complete grouting operation.
- The jet gun mixer, an integral part of the grouting assembly, regulates the viscosity of grouting mixture, keeping the grouting materials continuously moving.
- ***A Wider Selection of Grouting Materials***
- Halliburton offers many different types of cements for specific grouting operations.
- A great number of additives and water control agents for the improvement and modification of basic grouting materials are available.

HALLIBURTON OIL WELL CEMENTING COMPANY IS FINANCIALLY ABLE TO PERFORM ANY SIZE GROUTING OPERATION AS A PRIME OR SUB-CONTRACTOR

Halliburton Pressure-Grouting Method has been "job-proven" on:

DAMS
- Municipal dam repairs ... sealing foundation leaks
- New dams ... sealing foundations and forming cut-off walls

STABILIZATION OF UNCONSOLIDATED SAND AND SOIL
- Building foundations
- Compressor station foundations
- Tunnels
- Railroad railbeds
- Ground water control

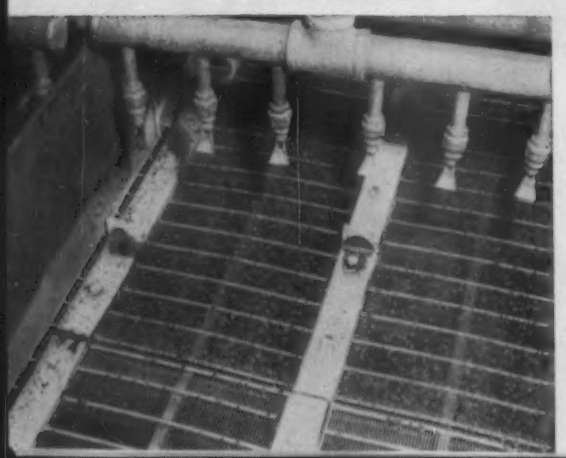
MINING
- Shaft water control
- LPG storage caverns

For additional detailed information and "job experience" data about the successful Halliburton Pressure-Grouting Services, write or contact Halliburton Oil Well Cementing Company, General Offices; Duncan, Oklahoma.

HALLIBURTON GROUTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

USS "T-1" Steel dipper weighs 5 tons less, scoops 10% more load. This shovel originally had a 30-cu.-yd. dipper (90,000 pounds capacity) that weighed 57,650 pounds. It was replaced with a 33-cu.-yd. (99,000 pounds capacity) dipper made of USS "T-1" Constructional Alloy Steel that weighs only 46,900 pounds—a clear saving of 10,750 pounds of steel. The new dipper has a capacity gain of 10%, or 9,000 pounds; yet its total weight, including load, is nearly one ton less than the old unit. "T-1" Steel is a natural for dipper and bucket construction. It has tremendous yield strength (100,000 psi min.), weldability and exceptional resistance to impact abrasion. This dipper was built by Bucyrus-Erie for use in the Red Ember Mine of the Truax-Traer Coal Co. near Fiatt, Illinois. Mr. Roy Leseney, Mechanical Superintendent of the mine, says that "T-1" Steel dippers are doing a marvelous job for them. They dig better, handle easier and last much longer than dippers previously used.



Stainless Steel? You can hardly wear it out! That's what John Robinson, Chief Foreman at the Truax-Traer Burning Star Mine says about the USS Stainless Steel used in vibrator screens, liners and chutes. The old iron screens wore out in 6 months but these stainless vibrator screens have been in for 30 months with little signs of wear. Another big advantage is that fine, wet coal doesn't stick on stainless steel. No cleaning at all has been necessary—an obvious saving in time, labor and money.

How Truax-Traer reduces mining costs with USS Special Steels

One sure way to reduce mining costs is to use stronger, brawnier steels that can take pounding, rough handling, and constant abuse. At Truax-Traer mines, USS High-Strength Steels, extra strong "T-1" Constructional Alloy Steel and Stainless Steel are very much in evidence. These special steels are boosting service life, increasing payloads, reducing downtime and saving operating dollars.

Here are the USS Steels that do more —and save more:

USS MAN-TEN Steel—High strength with abrasion resistance and economy. (Minimum yield point 50,000 psi)

USS COR-TEN Steel—High strength with superior atmospheric corrosion resistance and abrasion resistance. (Minimum yield point 50,000 psi)

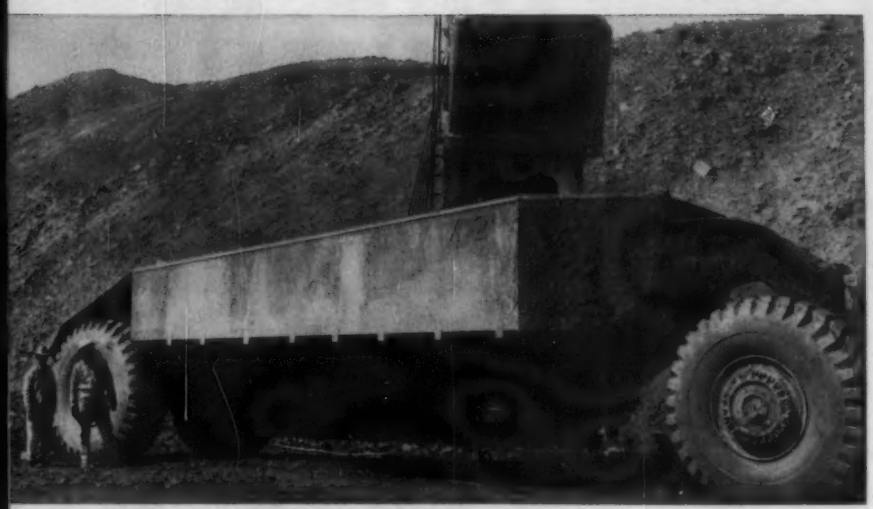
USS TRI-TEN Steel—High strength with toughness, weldability and abrasion resistance. (Minimum yield point 50,000 psi)

USS "T-1" Steel—Super strength with impact abrasion resistance, weldability and toughness. (Minimum yield strength 100,000 psi)

USS STAINLESS Steel—High resistance to corrosion, elevated temperature and abrasion.

Each of these USS Steels is superior for certain applications. Our metallurgists will help you choose the best steel for your job. Contact our nearest sales office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS, COR-TEN, MAN-TEN, TRI-TEN, and "T-1" are registered trademarks



60-ton high-strength steel trailer replaces three 20-ton units. Four of these giant Euclid trailers haul coal between the stripping operations and the tipple at Truax-Traer's Burning Star Mine #1 near Elkville, Illinois. Each one does as much work as three of the 20-ton units previously used—with a big saving in operating costs.

To get maximum capacity with low weight and low maintenance, the designers used two USS High-Strength Steels, COR-TEN and MAN-TEN brands. These steels have great ability to take shock, abrasion and wear and COR-TEN steel offers 4 to 6 times the atmospheric corrosion resistance of carbon steel. The trailers have been in use 6 months and no maintenance has been necessary.

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

USS

STAY OUT OF THE MUCK

NOW—Dust-free drilling without water!

...with the Le Roi LLV Dust-collecting Air Leg Drill

You'll drill fast, dry, and clean through the hardest rock with the new Le Roi LLV Dust-collecting Air Leg Drill. It outperforms wet-drilling machines and has a much lower dust count — you don't use a drop of water in the mine or tunnel.

The LLV's efficient dust collection keeps holes clean for faster, deeper penetration — prevents stuck steels and lost holes. Its powerful suction removes cuttings through the hollow drill steel and out the side of the chuck housing. *None* passes through the machine. Results: less maintenance and longer tool life.

What's more, dry cuttings permit continuous ore sampling — and all can be reclaimed!

Ask your Le Roi distributor for a demonstration. Or write Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

DRY "DUSTLESS" LLV collects cuttings in LX-1 dust box. Operator can empty box by remote control lever on drill.

LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-908

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Texaco Simplified Lubrication Plan

If you're using more than six lubricants for your major lubrication jobs, it's almost certain your maintenance costs are a lot higher than they should be. Storage problems, handling costs, and the dangers of misapplication are often costly results of stocking more lubricants than you need.

How Texaco Plan cuts number of lubricants

The Texaco Simplified Lubrication Plan is based on an analysis of your total needs. With this over-all picture in hand, the Texaco Lubrication Engineer can select a proven combination of multi-purpose and specialty lubricants that will cover your entire mining operation. In virtually every case, the whole job can be done with only six lubricants for *all* major lubrication.

Find out about the Texaco Plan yourself

Your nearest Texaco Lubrication Engineer can give you complete information on the Simplified Lubrication Plan. Just call the nearest of the more than 2,300 Texaco Distributing Plants, or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

☆ ☆ ☆

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LUBRICATION IS A MAJOR FACTOR IN COST CONTROL
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CATERPILLAR'S **No. 1** PROJECT

*PAYS OFF FOR YOU AGAIN**

New Cat Power Shift Transmission for D9 and D8 Tractors

CONTROL is mounted to the left of the operator. One selector lever eliminates gearshift, forward-reverse and flywheel clutch levers. The safety lever prevents accidental transmission engagement. The selector lever moves in a "U" path to various positions. To the left are three reverse speeds. To the right, three forward speeds. To change speed, simply move lever to the required position. To change travel direction, move lever to the opposite side. Changing speed and direction are as easy as that—without clutching—changes can be made while the machine is in motion under full load without loss of power or momentum.

HIGHER PRODUCTION PUSHLOADING: Power is quickly, easily adjusted to meet the demand. Shifting to higher gear boosts scraper out of cut quickly at higher speed. Speedy reverse quickly positions machine for next push.

HIGHER PRODUCTION BULLDOZING: As material builds up, Cat power shift transmission permits split-second shifting. There's a minimum of forward surge when the load is dropped. Instant reversing further slashes cycle time.

- **Shifts on-the-go under full load in a split-second!**
- **Changes speed, reverses direction with finger-tip control lever—and no clutching!**

The wraps are off—it's ready. After many years of research and on-the-job testing, Caterpillar now offers a revolutionary new drive for Cat D9 and D8 Tractors—power shift transmission. This new transmission—with an exclusive design—provides production highs never before possible with a track-type tractor. Here's why:

1. It combines for the *first* time the flexibility and anti-stall features of torque converter with the operating snap of direct drive. Because of its direct drive characteristics, it is more efficient than other power shifts.

2. With one control lever and no clutching, it reverses direction . . . changes speed . . . smoothly . . . under full load . . . in a fraction of a second.

Talk about productivity—the Cat power shift transmission delivers in a big way. Split-second on-the-go shifts give plenty of power in the highest gear possible. Shifting is so easy the operator just naturally gets more work out of the tractor. What's more, he gets it on the toughest, most demanding track-type jobs.

Besides the power shift transmission, you also have your choice of direct drive or torque converter in the D9 or D8. For complete facts on the new Cat power shift transmission see your Caterpillar Dealer. He's ready to explain in detail how it works, or to demonstrate its ruggedness . . . its ease of operation . . . its productivity. Name the date—he'll demonstrate!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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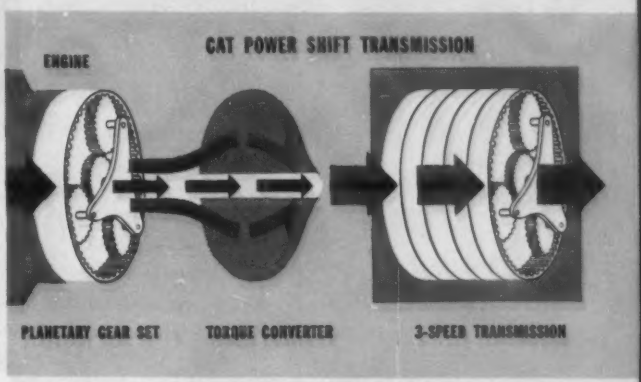
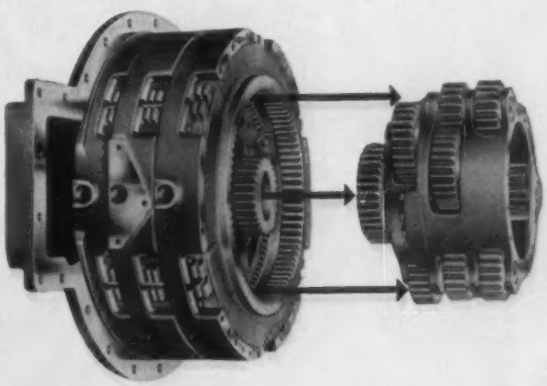
DIESEL ENGINES • TRACTORS • MOTOR GRADERS

EARTHMOVING EQUIPMENT

BORN OF RESEARCH
PROVED IN THE FIELD



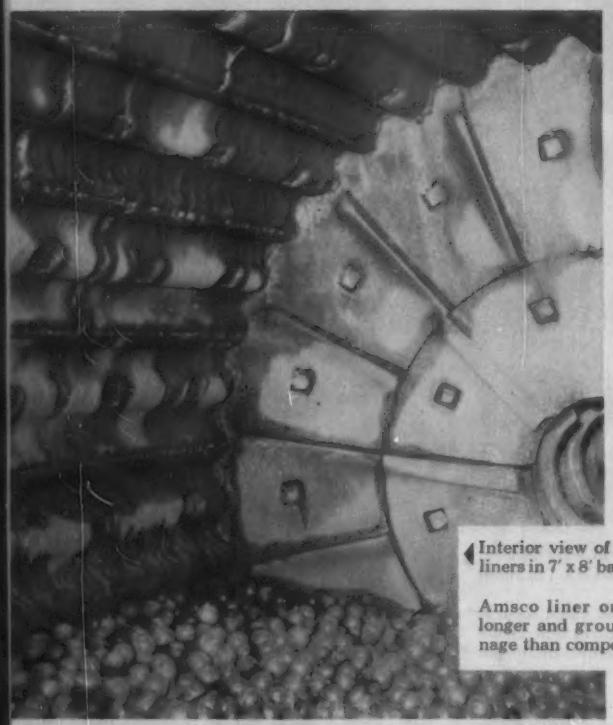
BASIC DESIGN: Total power is transmitted from the engine to a planetary gear arrangement mounted in the engine flywheel. The planetary divides and directs the total power—part goes through a direct drive shaft straight to the transmission and the remainder through a torque converter to the transmission. This enables the Cat power shift transmission to combine the snap and positive operating feel of direct drive with the anti-stall and flexibility features of torque converter drive. Its clean, unit construction design makes it easy to service, when required.



ONE TON OF RUGGEDNESS: Here's a portion of the components that make up the new Cat power shift transmission. Designed and built specifically by Caterpillar for its giant tractors, this rugged transmission weighs well over a ton. Every component is constructed for long-lived service. Selected alloy steel insures a transmission that stands up under the toughest conditions. Equally important, Cat power shift transmission comes to you thoroughly tested by exacting design and demanding field work in the heaviest earthmoving duty.

***CATERPILLAR'S NO. 1 PROJECT:** A multimillion-dollar research program—to meet the continuing challenge of the greatest construction era in history with the most productive earthmoving machines ever developed.

How AMSCO helps you HANDLE



Interior view of Amsco double wave liners in 7' x 8' ball mill, using 2" balls.

Amsco liner on left lasted 123% longer and ground 134% more tonnage than competitive liner on right.

Bucyrus 88 D four-yard bucket, equipped with Amsco Simplex 2-part Teeth, removing rock for power station. All of Tuscarora Constructors' shovels used for rock excavation are equipped with Amsco Simplex Teeth.

MORE TONS PER DOLLAR

Read how AMSCO Mill Liners and Dipper Teeth are outlasting competitive parts in severe service

AT A LARGE NEW YORK ZINC MINE...

THEY'VE DOUBLED SERVICE LIFE WITH AMSCO CHROME-MOLY BALL MILL LINERS

Amsco double wave chrome-moly liners are used on an Allis-Chalmers 7′ x 8′ ball mill at this large northern New York zinc mine. The mill is operating *24 hours a day, six days a week*... grinding rod mill discharge consisting of sphalerite, pyrite and the balance silicate and limestone gangue.

These Amsco liners ground 670,000 tons during their 29-month life... as against an average of 286,000 tons and 13-month life for the type of liners previously used. That adds up to over *100% increase in service life*. In addition to their longer life, another fact that impresses the operators about Amsco liners is that there's no circumferential grooving until the very end of their service life.

TUSCARORA CONSTRUCTORS HAVE FOUND...

AMSCO 2-PART DIPPER TEETH ARE "BEST-WEARING TEETH WE'VE EVER USED"

At the Niagara Power Project, Tuscarora Constructors are building the power station and pumping station. They're digging almost entirely in rock, working their dippers 24 hours a day, six days a week.

Dell Lundmark, Equipment Superintendent for Tuscarora, was responsible for selecting Amsco 2-part reversible teeth for his dippers. He'd heard of their fine performance elsewhere, and now describes them as the "best wearing teeth we've ever used". He says the design of the teeth is very good for rock, and adds, "We're getting *15% to 20% longer wear* than from competitive 2-part teeth".

Approximately 10,000 tons of rock are handled before the teeth are turned over ... and tips are easy to replace when completely worn.

This combination of a new alloy steel, plus the design features engineered into the Amsco Simplex Teeth, are causing equipment superintendents everywhere to change to Amsco for better, lower cost digging.

AMERICAN Brake Shoe COMPANY

AMSCO

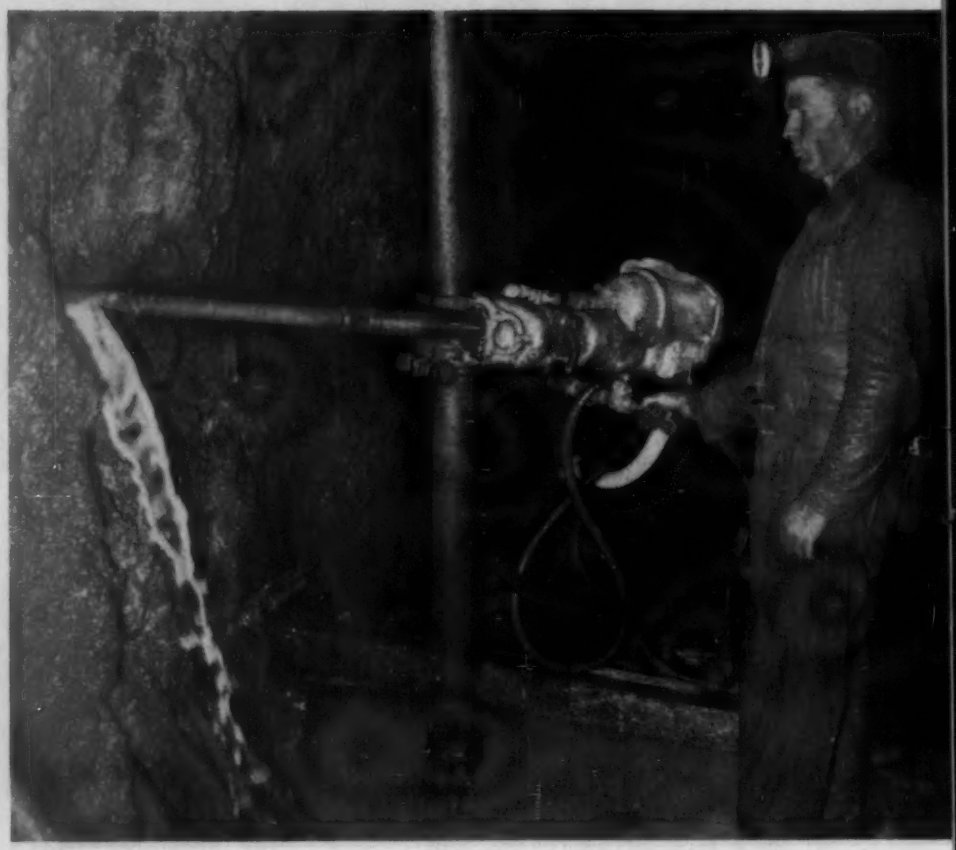
American Manganese Steel Division • Chicago Heights, Ill.

Other Plants in: Denver • Los Angeles • New Castle, Dela. • Oakland, California • St. Louis

In Canada: Joliette Steel and Manitoba Steel Foundry Divisions

NEW CP-65 AIR-DRIVEN DIAMOND DRILL handles with the ease of a drifter, because it's only 42½" overall and weighs just 200 pounds. Due to a big 20% increase in motor power over the world-famous CP-55, the CP-65 is the most productive, fastest and most powerful drill in its class. Coring Capacity 600-feet with EW rods and EX fittings.

Air motor requires minimum air per foot drilled and is reversible, permitting rapid unscrewing and screwing of rod joints . . . quick return of chuck to drilling position.



LICK TOUGH FORMATIONS AND TIGHT SCHEDULES WITH

CP "POWER VANE" ROTARY COMPRESSORS are available in capacities from 125 to 900 c.f.m. You can't buy a more dependable air supply. Compact and easy to start, they stay on the job until you say stop. Smooth running, economical performers, these "Power Vane" Rotary Compressors can be supplied with gasoline or diesel engine drive.

Set-up CP Drilling Equipment under the toughest conditions you have to face. Run it at top-rated capacity and watch it come through for you. Match its quick set-up time, hard hitting action, exceptional hole cleaning ability, against any equipment you've ever used. Whether you're doing exploratory, open-pit or underground work you'll find CP Drills built to lick your toughest jobs . . . help you beat tight schedules.

Other CP Drilling Equipment includes: Skid-mounted Diamond Drills, Stationary Air Compressors, Roof Bolting Equipment, Airlegs, Sinker Drills, Boom Arms, Shaft Sinking Jumbos, Pumps, and Air-powered Maintenance Tools all built to give . . . ease of operation—speed—safety.

NEWEST MEMBER OF THE CP LINE

The recent acquisition by Chicago Pneumatic of the REICH Brothers Manufacturing Company, Inc., with plants located in Terre Haute, Indiana, and Glasgow, Scotland, provides unexcelled diversification in blast-hole exploration, and water well Drilling Equipment.

REICHdrills, both truck and crawler mounted, are hydraulically-powered Rotary drills that are cutting drilling costs because of top hydraulic drive, infinitely variable drilling speed, easy one-man operation, quickest stem loading, dependable service.

REICHdrill
DIVISION: CHICAGO PNEUMATIC TOOL CO., NEW YORK

CP DRILLING EQUIPMENT

G-800 TRACDRIL is a self-propelled unit that moves readily from hole to hole. Easily pulls a 600 c.f.m. compressor up a 10% grade. This hard-slugging drill is equipped with the CP-450DR Deep-Hole Drill for sectional steel. Maximum capacity 3" holes to 75 feet. Fast acting hydraulic cylinders raise and lower drill carriage in seconds, also permit the driller to establish correct drilling angle on extremely bad ground and off level operations . . . gives him more productive drilling time. *The only machine on the market with automatic brakes.*

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

HYDRAULIC TOOLS • ROCK DRILLS • DIESEL ENGINES • AIR COMPRESSORS • PNEUMATIC TOOLS • VACUUM PUMPS • AIR BLAST BITS

ENGINEER'S FIELD REPORT

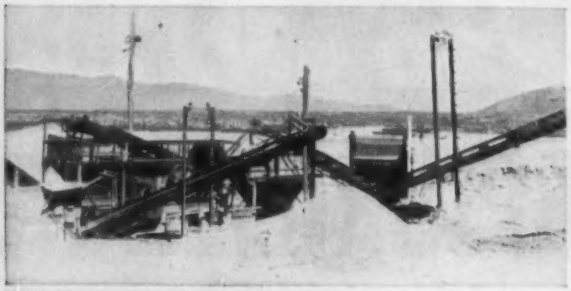
PRODUCT RPM DELO OIL

FIRM M. M. SUNDT CONSTRUCTION CO. Tucson, Arizona

RPM DELO OIL ends 5 years of engine troubles

The pan has never been off the Caterpillar D7 engine of this Link-Belt Speeder shovel in 7 years, using RPM DELO Oil. Only repair was a single valve job—no other parts replaced. William Naumann, Sundt's Operations Manager, says, "We tried nine different major brands of oil in five years, trying to lick the frequent breakdowns that slowed our operations. Sometimes, main and rod bearings even froze solid on the crankshaft. We changed to RPM DELO Oil seven years ago, and, since then, have never had any engine troubles due to oil failure. We now use RPM DELO Oil exclusively in our 22 heavy-duty engines."

Lubricated with RPM DELO Oil, this Caterpillar D 13000 portable unit powered a rock crusher of M. M. Sundt Construction Co. for a total of 8976 hours before overhaul. "In spite of extremely dusty conditions the only time the engine was touched was to replace a head—no other repairs were necessary," reports master mechanic Billy Gray, shown replacing air cleaner on unit following overhaul.



Austin 101 rock crusher, powered by Caterpillar unit described above, works 20 hours a day at firm's materials stockpile outside Tucson. Company works year around on road paving, grading, foundations, building construction.

Why RPM DELO Oils reduce wear —prolong engine life

● Oil stays on engine parts—hot or cold, running or idle ● Anti-oxidant resists lacquer formation ● Detergent keeps parts clean ● Special compounds prevent corrosion of bearings ● Inhibitor resists crankcase foaming

LUBRICATING OILS RPM DELO

For More Information about this or other petroleum products or the name of your nearest distributor, write or call any of the companies listed below.

TRADEMARK "RPM DELO" AND DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

RESULTS of a typical blast with DuPont HI-CAP 3 at this Moab, Utah, uranium mine.

LOADING DUPONT HI-CAP 3 (1¼" x 16") at Utex Exploration Company's uranium mine at Moab.

How DuPont HI-CAP® cuts blasting costs at the Utex Exploration Company's MiVida mine

When DuPont HI-CAP came on the market in the new, small-diameter sizes, Utex Exploration Company started using it in their uranium mine at Moab, Utah.

They find they sacrifice nothing in quality when they use this low-priced explosive. The grade they use—HI-CAP 3, 1¼" x 16" size—gives excellent fragmentation and good fumes.

Grade	Stick Count*	Water Resistance
HI-CAP 1	120	Good
HI-CAP 2	135	Fair
HI-CAP 3	150	None

*1¼" x 8" cartridges per 50 lbs.

You can cut your blasting costs appreciably in underground work with these new grades of small-diameter HI-CAP. The price is low—and the versatility of the complete line lets you use it in all types of shooting and under all but the most severe conditions.

Available now. For more information, check with your DuPont sales representative. He will be glad to arrange a trial for you.

Or you can write to Du Pont, Explosives Department, 6444 Nemours Bldg., Wilmington 98, Delaware.

DUPONT EXPLOSIVES

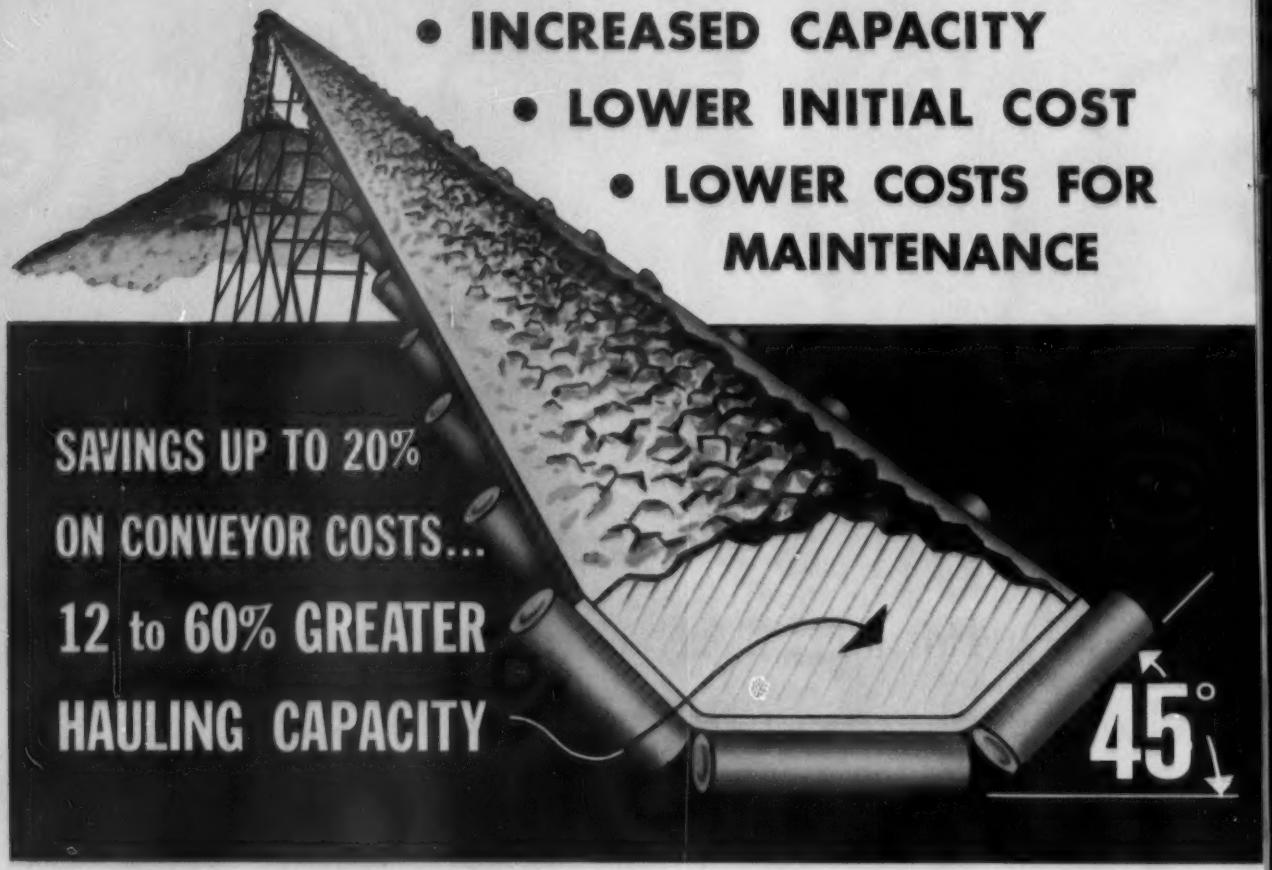
BETTER THINGS FOR BETTER LIVING

...THROUGH CHEMISTRY

MOST IMPORTANT NEWS

NOW YOU CAN USE 45° IDLERS

- INCREASED CAPACITY
- LOWER INITIAL COST
- LOWER COSTS FOR MAINTENANCE



It's a mathematical certainty that a belt can haul bigger loads with 45° idlers than with regular 20° idlers. But the 45° angle between concentrating idlers and bottom roll idlers is too sharp for an ordinary heavy duty conveyor belt. Plies separate, but modern RAY-MAN CONVEYOR BELT licks this problem . . . for all time!

Ray-Man's exclusive flexible construction and built-in stress compensation is guaranteed to take the sharp angle of 45° idlers without ply or cover separation at the hinge line. This opens a whole new era of conveyor design . . . permitting larger loads . . . narrower conveyors . . . assuring longer cover wear . . . lower handling costs!

RAY-MAN GIVES YOU "*MORE USE PER DOLLAR*" WITH 45° IDLERS

IN CONVEYING TODAY!

...TO HANDLE ALL MATERIALS

BIGGER LOADS, LESS SPILLAGE, LESS WEAR ON COVER WITH 45° IDLERS

20° IDLERS REQUIRE WIDER CONVEYOR TO HAUL SAME TONNAGE

Only RAY-MAN CONVEYOR BELT is BUILT to take the EXTRA STRESS OF 45° IDLERS

RAY-MAN IS GUARANTEED NOT TO PLY-SEPARATE AT 45° ANGLES

ORDINARY PLY BELTS ARE TOO BOARDY TO TAKE 45° ANGLES

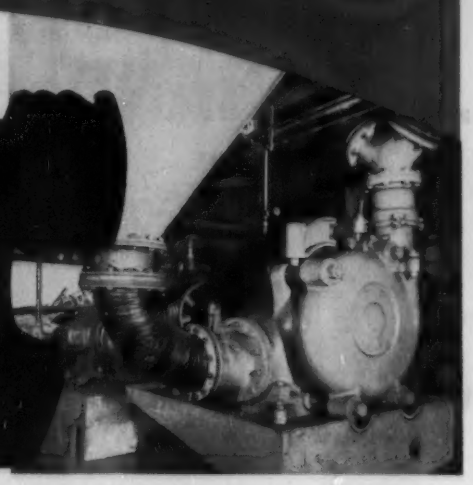
Ask your R/M representative to show you how Ray-Man Conveyor Belt with 45° idlers can give you the most for your conveyor dollar . . . write for new Bulletin M303, "Ray-Man for 45° Idlers."

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM

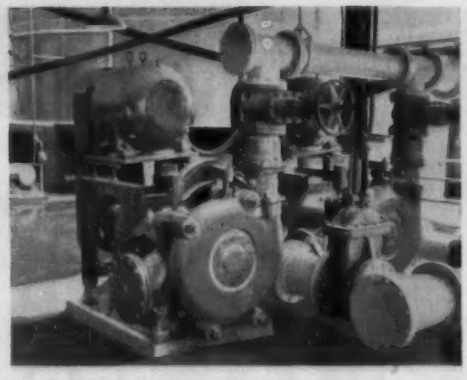
RM-661
ENGINEERED RUBBER PRODUCTS ... MORE USE PER DOLLAR

WILFLEY SAND PUMPS



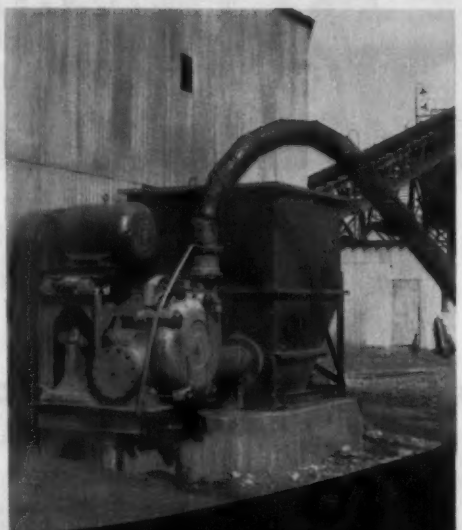
Versatility

to Solve Your SPECIFIC Pumping Problems



Every year the applications for Wilfley Sand Pumps become more varied. So **many** industries now require low cost pumping of sand, slimes, slurries—abrasive solutions of all types. Wilfley Sand Pumps are designed to meet all requirements in the transfer of solids. They may be fitted with interchangeable electric furnace alloy iron, special application alloys, or rubber-covered wear parts. Whether you need belt driven, overhead V-belt driven, or direct driven pumps, Wilfley has them—available in **1"**, **1½"**, **2"**, **2½"**, **3"**, **4"**, **5"**, **6"**, **8"** and **10"** discharge sizes with capacities to 3600 GPM and heads as high as 200'.

This all-around versatility plus continuous, maintenance-free performance and longer pump life make Wilfley the No. 1 choice of economy-minded plant operators throughout the world. To give you maximum economy in solids pumping, every Wilfley installation is **Job Engineered.**



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ENGINEERING AND MINING JOURNAL

OCTOBER 1959

How About a Long-Range STATE Minerals Policy, Too?

DEMANDS AND PROPOSALS for a "long-range national minerals policy" that will guarantee a "sound and profitable domestic mining industry" dominated several sessions at the American Mining Congress Convention in Denver (See p 18). Blame for failure to forge such a policy to date was aimed at the Administration, on one hand, and at the Congress, on the other, for failing to legislate proper directives.

Whoever is going to have to integrate the divergent views of segments of the U.S. mining industry into an acceptable national minerals policy will find the task formidable. The recent conflict of opinion on how quotas should be applied to ores and concentrates is but one example. Reason for these conflicts is clear. The U.S. mining industry is made up of some companies which are strictly domestic, others which are part foreign and part domestic, and some which are essentially foreign— yet all are owned by a large body of American citizens whose interests must also be considered.

If these divergent elements can be induced to yield a point of selfish interest here and there, a constructive long-range minerals policy will be possible. But in the framing of this policy, we may be risking the oversight of a significant flaw in the attitude of the domestic industry— that of shucking off all blame for current problems on the foreign producer, Washington, or even another competitive producer. Actually the remedy for many of our problems may lie within the grasp of individual mining states. Certainly without constructive state minerals policies, no national policy could possibly be effective.

Interviews with mining men at the convention and elsewhere indicate that many areas of the U.S. are unattractive to venture capital because of discouraging state politics and state tax policies. We mention politics specifically, because each time we asked why efforts to encourage mining were defeated, we met with the same answer—the farmers, the fishermen and hunters, the laborers, the conservationists, and non-mining businessmen outnumbered the mining voters.

In some cases state "nationalism" or state "provincialism" is responsible for discrimination against out-of-state or "foreign" mining venture capital.

Under a democratic system, each state can run its own affairs in any way that it wants to, and its legislators can conform to the will of the majority of voters. But when such conformance drives hundreds of millions of dollars of investment in iron mining into Canada or South America; when conservation and recreation interests are so highly regarded that large companies are forced to drop attractive exploration programs, and look elsewhere for mineral deposits, let's not damn the foreign producer, Washington, or poor national mineral policies for all of our domestic mineral problems. Every dollar of mine investment capital that is driven out of the U.S. by adverse state policies creates just that much more foreign competition to face in the future.

Wouldn't it be refreshing if just one state in the Union would offer a five-year tax moratorium to help new mining ventures get on their feet as some of the Canadian provinces do?

The chief problem in framing an attractive state mineral policy will be to win over the confidence and support of non-mining voters. This can be done by showing that mining is a real asset to the state, also that most mining deposits are so low in grade that they are virtually valueless in the ground. Their real value accrues in the amount of work that has to be done on the ore to mine, mill, smelt and refine it. In this respect labor, business, transportation, power and the tax coffers share handsomely in the revenues produced.

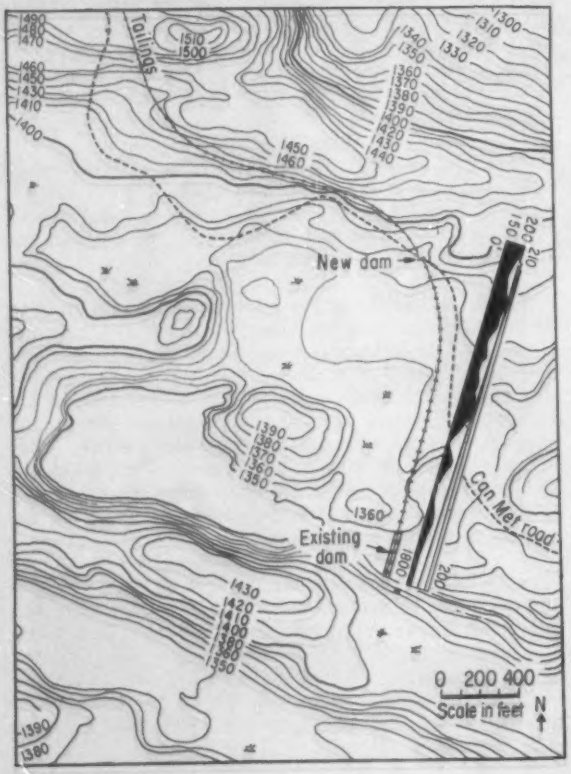
State and regional mining associations in Wyoming, Colorado, Idaho, Nevada, Utah and elsewhere have performed heroically in striving for these goals, and mining companies have launched public relations programs to accomplish the same purposes.

But we still feel that the greatest burden will have to be carried by the state politicians whose job it is, after all, to integrate divergent views into sound state policies and programs. Perhaps it is this problem on a national basis that prompted Senator James Murray of Montana to say at AMC in Denver "In the not too distant future, the minerals industry will find powerful and effective allies . . . The miner, the farmer, the woodsman, the fisherman and our great labor unions will stand shoulder to shoulder, as they should, to protect the national economy from the assaults of foreign competition."

In the final analysis, it is clear that if we are to develop attractive state or national minerals policies, it will be the job of the mining industry to assist politicians in converting antagonists into "powerful allies." In this job, the public relations program of mining companies, state and regional mining associations, and mining publications can do much to win the approval of mutually beneficial state minerals policies.

CAN-MET's B. J. Holiday (center above) designed the mobile wet cyclone rig used to build a dam over very rough terrain.

A WINCH to retract the pipe, wheels fore and aft, a wooden pipe to take away the slimes, are features of the apparatus.



CAN-MET EXPLORATIONS LTD. and Stanrock Uranium Mines Ltd. share common ground—96 acres in all—for tailings disposal at their Algoma Basin uranium operations. To comply with Provincial laws, which strictly forbid the escape of any effluent from uranium leaching operations, the two companies decided to build a series of dams to enclose the common disposal area. Stanrock built a small dam on the southwest side (see map) and Can-Met's service department was to construct the larger dam—1800 ft in length—along the eastern edge of the area to a height sufficient to hold all the tailings contemplated in the uranium producing contracts which expire in 1963.

The authors describe the unique, mobile—almost self-propelling and in some cases actually self-advancing—tailings dam building rig which originally consisted of three 10-in. cyclones but now consists of five. After the two passes described below, a third pass was begun in mid-July at the time of *E&MJ's* most recent visit to the camp. This latest run of the apparatus will raise the tailings dam about 25 ft above the level of the old Can-Met road and is expected to reach the far end of the pond in February 1960, providing sufficient holding capacity for the two mills until August 1961. A fourth pass will be made—adding 12 ft to the height of the dam—within the Eldorado contract period.

Can-Met builds the large dam and operates the rig. Stanrock built and maintains the smaller dam, and the total cost is split by the two companies. Total production capacity of the two mines and their mills is 6,300 tpd, but at the present time the mills operate at a combined rate of about 5,500 tpd. Can-Met Explorations is managed by John Kostuik, who is also general manager of Consolidated Denison located across Quirke Lake.

Can-Met's mill tailings are pumped from the mill (to the north of the pond) to an open-topped box 1400 ft south of the mill through a 10-in. dia wooden stave pipe and then the tailings gravitate to the sand-making rig. At the start of the third run, the rig was 1700 ft from the mill and it will be about 3900 ft away when at the far end of the dam.

When the dam is completed—after the fourth traverse—Can-Met tailings will be discharged to the pond through spigots placed at intervals along the tailing pipe over a length remote from the decantation towers.

TWO PASSES over the dam length have been completed and a third is under way, having started at the lower right and filled in the area occupied by the bridge and the trestles. One more pass—starting 300 ft further back—will be made before 1963.

Mobile Cyclones Build Tailing Dam

B. J. HOLIDAY

RAYMOND WILKS

IN APRIL 1958 the tailings disposal area consisted of a small lake bounded on one side by high ground and on the other by an undulating area, parts of which were only a few feet above the level of the tailings. The outlet from the lake was closed by an earth dam, the top being just above the tailings level.

Can-Met Explorations Ltd.'s engineering department estimated that the level of the tailings would have risen 18 ft by the spring of 1959, and that the tailings must be contained in the area shown on the map. This required a dam 1800 ft long, varying in height between zero and 30 ft, the new formation to join with the existing earth dam, which would be increased in height by 20 ft.

As the area carried little overburden, with bald rock outcrops much in evidence, an earth dam of the necessary proportions was impractical —mill tailings were the obvious choice for building material.

Wet cylones (10-in. dia) were already being used to build a formation across a small valley which was to carry the tailings line to the point where the construction of the dam would start. The work provided an opportunity to study the performance of cyclones and to assess their suitability for the construction of the main dam. The cyclones were working initially on an inlet pressure of about 5 psi, which, with increased head, reached about 10 psi on the far side of the valley. They were mounted on stub pipes branching at an angle from either side of a central 10-in. dia pipe coupled directly to the tailings line, and carried on trestles across the valley.

With this arrangement the distribution to the cyclones was uneven, and the underflow output was low. An analysis of the product from the cyclones (Fig. No. 1) suggested that the coarse material was suitable for the construction of the dam. The static head at the point where the construction of the dam would commence would be 89 ft, and it was considered that the performance of the cyclones would be satisfactory at the increased pressure. However, the time taken to advance the apparatus along the trestles and to extend the pipeline was considerable; sand was deposited in a series of cones which had to be levelled by hand into a continuous formation and much labor was required to erect the trestles.

We had no experience in building tailings dams in sub-zero temperatures, or in the performance (if any) of cyclones at low temperatures. Local practice was to avoid such construction work during the winter and it was decided that if cyclones were to be used, the dam must be completed by early November. The operation therefore called for speed with minimum labor. It could not be done using the trestle method of extension; also the labor costs would be prohibitive.

To get the job done quickly and at low cost these requirements would be necessary: to deposit the sand exactly where required in the dam formation directly from the underflow of the cyclones and for the apparatus to build its own track.

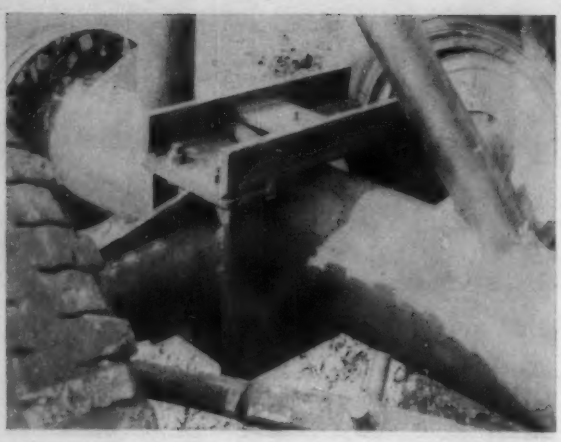
To do this successully the apparatus must not advance by steps, but progressively. The number of shutdowns required to extend the pipeline and the length of those shutdowns had to be kept to a minimum.

A carriage was therefore devised, consisting of a 10-in. dia steel pipe, 42 ft long. On one end of the pipe a gland was fitted through which an 8-in. dia steel pipe, 42 ft long, ran inside the 10-in. pipe. The 10-in. pipe was fitted with four ¾-in. pipe connections spaced along the top, and four 1½-in. pipe connections spaced along the bottom so that the pipe could be flushed out should the apparatus become so packed with sand as to prevent extension and retraction (this did not happen).

A forked fitting carrying three 4-in. pipes (the two outer ones 12 ft long and the center one 13 ft long) was fitted by a flange to the other end of the 10-in. dia pipe. The three 4-in. pipes were connected near their outer ends by a 3-in. pressure balance pipe which also served to stiffen the structure. The balance pipe was then fitted with valves which were to be opened occasionally to ensure that the pipe was kept free from sand. At the ends of the 4-in. pipes, three 10-in. dia wet cyclones were fiitted, the distance be-

Mr. Holiday is plant superintendent and Mr. Wilks is service engineer, Can-Met Explorations Ltd., Sprague, Ontario.

THE RIG will extend itself when operated above 40 psi pressure, but a small hydraulic jack is used at low pressures.



ANOTHER modification has been to provide some steer to the front end by welding on king pins and attaching the turnbuckle.

ADJUSTABLE trailing wheels help steer the machinery in the desired direction. Screwing down on the hand wheel raises the rear end of the swing arms, which are pivoted at their centers, and lowers the farther ends to which the stub axles are secured.

CAN-MET's 2100 ft of dam are managed by the authors—B. J. Holiday and R. Wilks (below) of the service department.

tween centers of the outer ones being 7 ft. Overflow was carried away by a manifold to the back of the pond. The longer branch pipe positioned the center cyclone ahead of the other two, to reduce overlapping of the sand cones built up by the cyclones until they had reached dam height, and so prevent the center of the formation from building up more quickly than the sides.

The whole was mounted on an undercarriage. The main wheels consisted of the rear axle casing and double wheels from a 5-ton truck, the 10-in. pipe being passed through the differential housing. The trailing wheels were made adjustable for height so that alignment of the inner and outer pipes could be maintained during extension. The weight of the apparatus, including cyclones and overflow manifold, was approximately 4,500 lb. When in operation, the tailings would add a further 4,000 lb. The outer end of the 8-in. pipe was connected to the 10-in. dia wood stave pipeline which carried the tailings from a box 2200 ft away, and 89 ft higher. A quick action dump valve was installed in the line close to the carriage.

The device had a safe extension of 37 ft, and a safety chain was fitted from the trailing end of the 10-in. dia pipe to the outer end of the 8-in. pipe, limiting the distance traveled.

The formation across the small valley previously mentioned was completed, with the original layout of trestles and multiple cyclones, by late June. The pipeline was laid to the point where the construction of the dam was to start, and the apparatus was assembled.

The installation was put into operation on July 22 and performance of the cyclones proved satisfactory, each producing approximately the same quantity of coarse material. The pressure was 29 psi and the total output about 19 tons/hr.

It was considered that there would be some tendency for the carriage to move forward without assistance at the pressures which would be encountered—but this happened only after the pressure had reached about 40 psi.

A hydraulic jack was brought into service to extend the telescope and a clamp was made to fit the 8-in. pipe. The jack was used between the clamp and the gland on the 10-in. pipe, a block being placed between the flanges to prevent compression of the gland. The clamp followed up and was reclamped after each full extension of the jack.

When the carriage had travelled forward 37 ft, building the dam to full height and width, the 8-in. pipe was disconnected from the tailings line and drawn back inside the 10-in. pipe, the

carriage remaining at its forward position. The gap was then filled with wood stave pipe and the 8-in. pipe recoupled. At first some difficulty was experienced in jacking out the telescope, and particularly in retracting it. Retraction was effected by chain blocks coupled to "wings" which were welded on either side of the gland, and on either side of the outer end of the 8-in. pipe. The tightness was eventually traced to too small a clearance between the bore of the back ring of the gland and the 8-in. pipe. A scale formed on the bore of the ring, finally seizing it to the pipe. The ring was given 1/16-in. clearance all round, and a connection, originally provided to flush the gland with water, was fitted with a grease cup. No further trouble was experienced, providing the alignment of the pipes was maintained; a simple operation with the adjustable trailing wheels.

The original overflow manifold, which discharged at an angle of about 70° to the line of the dam, was satisfactory on a low formation (up to 12 ft high) where the ground sloped away from the dam. A single tail pipe, cantilevered from the end of the manifold, was sufficient to carry the overflow away from the toe of the dam. A pipe was connected to the opposite side of the manifold as a balance weight.

Changing Manifolds

An alternative overflow manifold was used where the formation was high and where difficulty would have been experienced in getting the overflow away from the vicinity of the dam. The manifold discharged through a flexible hose 50 ft long, threaded inside a line of wood stave pipe which carried the overflow off the dam at a convenient point.

Construction of the dam proceeded on a continuous down grade. During the first 31 days of operation, from July 22 until Aug. 22, 440 ft of dam was constructed. It was during this period that trouble was experienced with the extension and retraction of the apparatus, and the corrective steps taken. This section of the dam varied in height from 6 to 21 ft, and was 9 ft wide at the top. It contained an estimated 11,400 tons of tailings. The cyclones were in operation for 540 hours, giving an average output of 21.1 tons per hour at an average inlet presure of 31 psi.

A further 320 ft of dam were constructed, reaching a point where the terrain was at dam height on Sept. 6. This section of the dam varied in height from zero to 21 ft and contained an estimated 6,800 tons of tailings. The cyclones operated 272 hours, giving an average output of 25 tons

Fig. No. 1—Wet Cyclone Performance at 10 psi

Mesh	Feed		Cyclone sands		Overflow	
	Percent	Dry tons (1.166 t/min)	Percent	Dry tons (0.163 t/min)	Percent	Dry tons (1.003 t/min)
Plus 48	0.2	0.0023	0.8	0.0013	0.1	0.001
Minus 48 plus 65	2.4	0.028	9.6	0.016	1.2	0.012
Minus 65 plus 100	9.9	0.1157	37.2	0.061	5.4	0.0547
Minus 100 plus 150	9.4	0.110	22.4	0.035	7.4	0.075
Minus 150 plus 200	14.2	0.165	16.0	0.026	13.8	0.139
Minus 200	63.9	0.745	14.0	0.0237	72.1	0.7213
	100.0	1.166	100.0	0.163	100.0	1.003

From the above, the percentage of the various screen sizes reporting in the underflow sands are:

Mesh	Percent on screen	Percent of total tailings
Plus 48	56.5	—
Minus 48 plus 65	57.1	57.0
Minus 65 plus 100	52.7	53.6
Minus 100 plus 150	31.8	44.2
Minus 150 plus 200	15.7	33.0
Minus 200	3.1	13.9

Fig. No. 2—Wet Cyclone Performance at 38 psi

Mesh	Feed		Cyclone sands		Overflow	
	Percent	Dry tons (2.0 t/min)	Percent	Dry tons (0.45 t/min)	Percent	Dry tons (1.55t/min)
Plus 48	0.4	0.008	13	0.0058	0.1	0.0022
Minus 48 plus 65	2.9	0.058	10.5	0.0473	0.7	0.0107
Minus 65 plus 100	12.1	0.242	36.6	0.1647	5.0	0.0773
Minus 100 plus 150	9.9	0.198	17.6	0.0792	7.7	0.1183
Minus 150 plus 200	13.1	0.262	15.4	0.0693	12.4	0.1927
Minus 200	61.6	1.232	18.6	0.0837	74.1	1.1483
	100.	2.0	100.0	0.45	100.0	1.55

From the above, the percentages of the various screen sizes reporting in the underflow sands are:

Mesh	Percent on screen	Percent of total tailings
Plus 48	72.5	—
Minus 48 plus 65	81.6	80.5
Minus 65 plus 100	68.0	70.7
Minus 100 plus 150	40.0	58.7
Minus 150 plus 200	26.8	47.7
Minus 200	6.8	22.5

Fig. No. 3—Wet Cyclone Performance at 40 psi

Mesh	Feed		Cyclone sands		Overflow	
	Percent	Dry tons (2.3 t/min)	Percent	Dry tons (0.56 t/min)	Percent	Dry tons (1.74 t/min)
Plus 48	0.1	0.002	0.2	0.0011		0.0009
Minus 48 plus 65	2.4	0.055	5.3	0.0297	1.5	0.0253
Minus 65 plus 100	13.2	0.304	33.1	0.1854	6.8	0.1186
Minus 100 plus 150	10.5	0.242	17.7	0.0991	8.2	0.1429
Minus 150 plus 200	13.5	0.310	19.3	0.1080	11.6	0.2020
Minus 200	60.5	1.387	24.4	0.1367	71.9	1.2503
	100.0	2.3	100.0	0.56	100.0	1.74

From the above, the percentages of the various screen sizes reporting in the underflow sands are:

Mesh	Percent on screen	Percent of total tailings
Plus 48	55.0	—
Minus 48 plus 65	54.0	54.0
Minus 65 plus 100	61.0	59.9
Minus 100 plus 150	40.9	51.2
Minus 100 plus 150	40.9	52.2
Minus 150 plus 200	34.8	46.4
Minus 200	9.9	24.3

per hour at an average inlet pressure of 33 psi.

The terrain was at dam height for the next 120 ft, and the carriage was disconnected from the wood stave pipe and moved forward over the ground for this distance. The pipeline was extended and the carriage re-connected.

From this point the output from the cyclone began to increase rapidly. At a point 1,030 ft from the starting point, and 105 ft below the tailings box, where the pressure was 38 psi, the measured output was 27 tph. The analysis is shown in Fig. No. 2. From here the dam was widened to 12 ft at the top of the formation.

On Sept. 30, construction had reached a point 1230 ft from the starting point. From the 6th of September until the 30th, 390 ft of dam was constructed varying in height between zero and 30 ft, and containing an estimated 15,100 tons of sand. The cyclones operated 511 hours for an average output of 29.5 tph.

From here to the beginning of the earth dam was 210 ft, containing an estimated 10,500 tons of sand. This section was completed by Oct. 17, three days ahead of the estimated date. The cyclones operated for 340 hours, averaging 30.8 tph output.

In the spring it had been necessary to raise the existing earth dam immediately to a height sufficient to contain the tailings until the new dam had reached and crossed it. The height was therefore increased by 8 ft, with earth scraped by bulldozer from the rocky surroundings. The dam was then 260 ft long and 18 ft wide at the top, with a downstream slope of 45° measuring 48 ft.

This section was crossed with the center line of the carriage over the upstream edge of the top of the earth dam, the height starting at 15 ft, falling on about a 1% grade to 12 ft 6 in. at the far end. The width at the top of the formation was increased to 18 ft. The tailings already in the area had entered at a point remote from the dam, and in consequence, the material against the earth dam was mainly slimes covered by a few inches of clear water. These slimes were displaced to an undetermined depth and raised above the water level some way back in the lake by the coarse material from the cyclones. The formation reached the high ground on the far side of the earth dam Nov. 9. The cyclones were in operation for 521 hours on this final section. From the known output of 33 to 34 tons per hour, sampled when the new formation had reached the half way mark on the earth dam (Fig. No. 3), the sand content was estimated to be 17,700 tons.

Total estimated sand content of the dam was 61,500 tons, the total operating hours 2,184, and the average output 28 tph.

Experience has suggested some modifications to the apparatus would permit a reduced operating staff, provided that safety considerations did not preclude a lone shift operator.

Recent Modifications

In order that the carriage should be either easier to extend or completely self propelling, (whichever condition appears the most desirable) the diameter of the inner pipe of the telescope should be chosen in accordance with the pressures to be encountered. With the apparatus described, the tendency to extend without assistance became evident at about 40 psi with the gland tightened just sufficiently to prevent leakage. At this pressure the cross-sectional area of the 8-in. pipe used produces a force of about 2,000 lb.

The three-way fork should be made as a unit, the branch pipes being fitted by a flange. The dump valve should be fitted forward of the fork and would, in addition to its normal duty, serve as an inspection door so that any foreign body carried down with the tailings and forcing an obstruction could be removed. During the operating no obstruction occurred at this point, but it was an ever present danger. The gland on the other end of the 10-in. dia pipe should be made as a separate unit, and would be fitted by flange.

A few degrees of adjustable steer should be incorporated in the main wheels in order to more readily negotiate a curve.

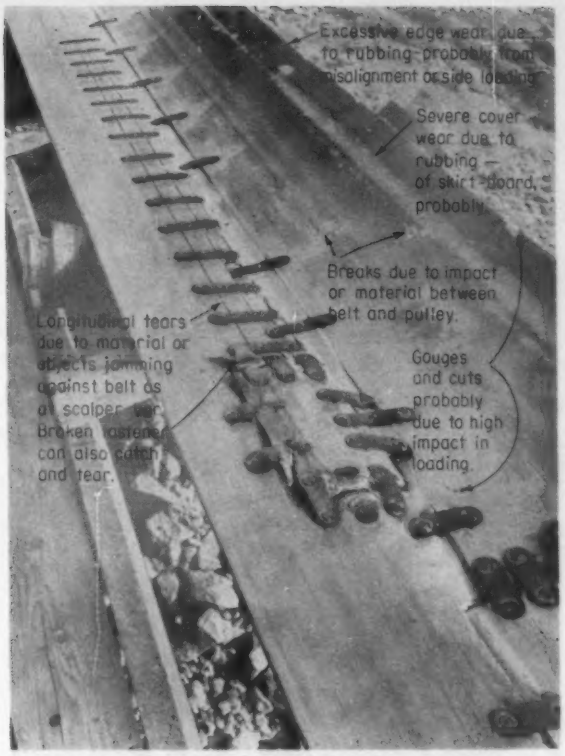
SALT will be won from beds in Baja California with the GMC rig at left.

Machine Harvests Solar Salt Crop

A MACHINE that can harvest 1,000 tpd of salt has recently been completed for use on the Black Warrior Lagoon solar salt beds of Exporta del Sal, joint subsidiary of Seatankers, Inc. and National Bulk Carriers, Inc. So far is as known, the General Motors Corp. Detroit Diesel Engine Div. machine is the largest of its kind in the world (it weighs 25 tons), and the salt deposits of the Black Warrior are said to be the world's largest in commercial production.

Crystals grow on top of the solar beds through the tidal action of the ocean and a heavy drag is used to knock off the crystals. Controlled flooding with sea water, sun and wind combine to produce solar salt. When drying-out reaches the proper stage, the GMC harvester is pulled through the bed by a rubber-tired tractor. The harvester's cutting blade lifts the crystals to a pick-up conveyor which feeds to a second conveyor that drops the salt into a hopper. From the hopper, the product goes by diesel-powered tractor-trailers to the marine terminal where it is shipped to Canada for use in paper making.

An 85-hp diesel engine mounted on the harvester operates the conveyors and through hydraulics controls the angle and elevation of the cutting blade. A ship's trim gage provides visual control of the cutter.


Excessive edge wear due to rubbing probably from misalignment or side loading
Severe cover wear due to rubbing — of skirt board, probably
Breaks due to impact or material between belt and pulley.
Longitudinal tears due to material or objects jamming against belt as at scraper bar. Broken fastener can also catch and tear.
Gouges and cuts probably due to high impact in loading.

BAD OPERATING CONDITIONS have killed this belt.

TRANSVERSE BREAKS IN CARCASS are a major source of belt failure. The direct causes are generally found in excessive loading impact or material between belt and pulley.

How to Avoid Conveyor Belt Failure

N. J. CYPHERS

ESSENTIALLY, all premature conveyor belt failures are associated with carcass, edge or fastener troubles and not cover wear (see inset box for description of belt components). And probably the greatest single source of failure lies in transverse carcass breaks. Only by proper use and maintenance of a properly made and selected belt can premature failures be reduced.

The various failures together with their causes and prevention can be classified as follows:

1. Edge Failures are generally a direct result of the belt rubbing against some part of the equipment. The rubbing action may develop through:

a. Misalignment of equipment. The operator should have his entire equipment checked if this condition appears. The use of self-aligning idlers or training idlers will help prevent rapid destruction of the belt but can hasten ply separation in the case of vertical side idlers.

b. Too stiff a construction, resulting in the belt running off the idlers. A properly engineered belt, using today's newest fabrics, will help prevent trouble from this cause.

c. Side or off-center loading onto belt, causing belt to ride high on one side. The operator can control this by better loading technique.

2. Fastener Failures are frequently encountered on screw-take-up installations where tension control is not automatic or where higher tension is used to combat excessive slipping caused by wet operating conditions. There are two types of failures associated with fasteners:

a. Straight pull-outs, caused by:

(1) Running belt tension at a level considerably higher than is recommended by the belt manufacturer.

(2) Too small or too large a fastener for the belt construction as recommended by the fastener manufacturer.

(3) Poor installation of fasteners, i.e., not properly tightened, thereby allowing excessive flexing and tearing at splice, or not properly lined-up to evenly distribute the load. Use of fastener manufacturer's proper template will help prevent this condition.

(4) Undersize pulleys, which place an added strain on the fastener area and hasten carcass weakening and ultimate pull-out. Can be avoided by using manufacturer's recommended pulley sizes.

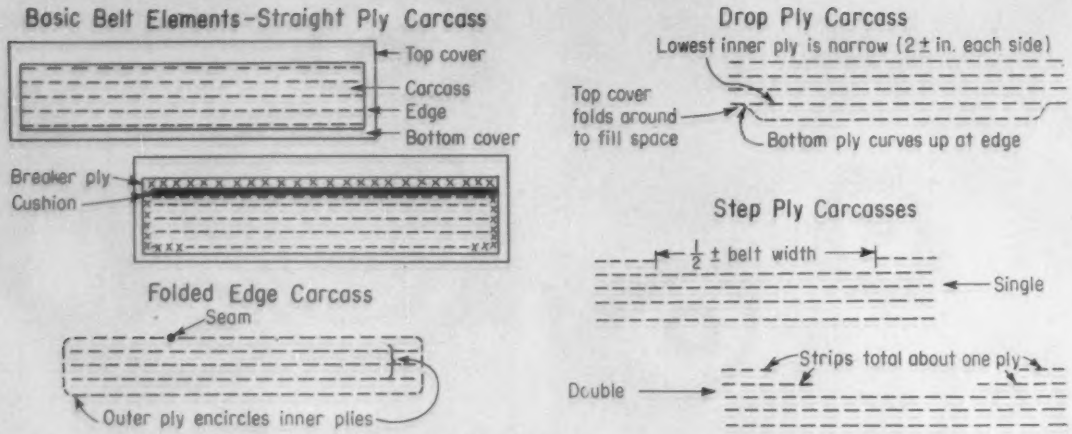
(5) Weakening of carcass due to mildewing of cotton members on wet installations. Having manufacturer supply mildew-inhibited carcass and the use of rubber cement at bolt holes when making a splice will minimize such failures.

b. Longitudinal tears, resulting from:

(1) Broken or worn-out fastener getting caught and starting a tear. Systematic inspection will help prevent this.

(2) Poor carcass reinforcement at edge which allows the end fastener to pull loose, letting the

Mr. Cyphers is director of research and development for Boston Woven Hose & Rubber Co. division of American Biltrite Rubber Co. at Cambridge, Mass.



Construction of Conveyor Belt Is Designed to Fit Usage

The principal elements of a conveyor belt are:

The carcass or strength element which supports the load and transmits the motive force;

The cover or protective element which resists destruction of the strength element by the material conveyed, the environment and the wear incidental to running over idlers and pulleys.

Frequently, other special elements are also used, such as:

A breaker ply, a layer of open-weave fabric used between cover and carcass to provide greater adhesion, which cuts the tendency of covers ⅛-in. and heavier from gouging and stripping in large pieces, and to help distribute loading impact.

A cushion, a thick layer of soft, resilient rubber between the harder, wear-resistant cover and the carcass—either above or below any breaker ply—to reduce cutting and gouging of the cover and rupture of carcass when large, heavy, sharp lumps are being loaded.

The carcass usually consists of several layers or "plies" of woven fabric separated by thin layers of "skim coats" of rubber. The skim coats permit inter-ply movement while retaining a continuous bond between plies. The fabric is generally impregnated or at least surfaced with a rubber called "friction" which protects the fabric as well as cements the layers together.

The woven fabric normally used has a weight of about 19 to 42 oz per sq yd. Better than 90% of the fabrics contain cotton although a greatly increasing amount now have either nylon or rayon as the filling or transverse member.

Cotton, as the warp or longitudinal member, is used due to its good cost-strength-bulk ratio. Rayon and nylon have higher strength-to-cost ratio but their low bulk results in very light fabrics in the lower operating tension ranges.

Nylon, as the filling, provides excellent transverse flexibility (desirable for good troughing), high resistance to longitudinal tearing, high resistance to impact failure and of course is impervious to mildewing.

Rayon, as the filling, has, to a lesser degree, the same advantages as nylon but is affected by mildew in a fashion similar to cotton. Both rayon and cotton must be protected with chemicals against the weakening action of mildew in moist or wet installations.

Special carcasses are infrequently used where greater transverse flexibility, lower stretch or extreme tensions are required. These generally have textile cords or steel cables for longitudinal strength and fabrics for some lateral strength and stiffness.

Carcasses are constructed as shown in the drawing above.

The characteristics of the variations are as follows:

Straight ply—least apt to train crooked because it is easy to keep all plies under uniform stress during manufacture; best for holding fasteners because all plies are full width.

Folded edge—better edge adhesion than straight ply; may have tendency to run crooked due to possible distortion when folded ply is wrapped around straight plies.

Drop ply—heavier cover thickness on bottom of edge where excess wear is often encountered; not as good for holding the edge fastener as a full construction.

Step ply, single—thicker top cover in center of belt when tensions do not require full ply; poorer for holding fasteners than full ply construction.

Step ply, double—greater transverse flexibility and thicker top cover in center; does not hold center fasteners as well as full ply construction but holds them better on edges than a belt having just one extra full ply.

Covers are generally furnished in one of three grades of rubber depending on the wearing severity of the material conveyed:

Lowest grade is used in only the easiest of services and is identified by an industry rating of 800 to 1000 psi tensile strength range.

Middle grade is the most widely used as it provides the best economical balance for all but the most severe impact, tearing and gouging applications. This grade has a 2500 to 3000 psi tensile strength range.

Top grade with a 3500 to 4000 psi tensile strength range is used only in the most severe applications.

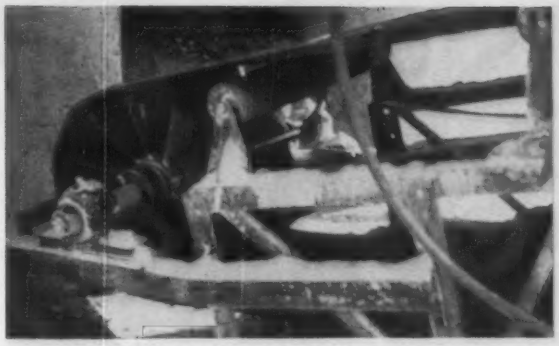
Thickness is of equal importance to the grade of rubber in designing or selecting a cover. Covers 1/16 in. or less in thickness should only be used on the easiest jobs. Normally, top covers will be ⅛ in. or heavier as the severity of loading and wear increases. The bottom cover, normally, is 1/32 in. to 3/16 in. in thickness. The 1/16-in. bottom cover generally is found with top covers over ⅛ in. or where unusual bottom wear occurs. A "raised center" top cover, having greater thickness in the center portion of the belt, is sometimes used to combat greater abrasion and impact in the center than at the edges.

Edges are generally made of the same quality rubber as the rest of the cover. The thickness is made to vary with the severity of edge wear conditions encountered. Generally, heavier edges are provided where extra wear is the rule due to equipment misalignment such as is frequently found underground. Excessive thickness must be avoided where belts are made endless with metal fasteners to insure proper anchorage of the outer fastener.

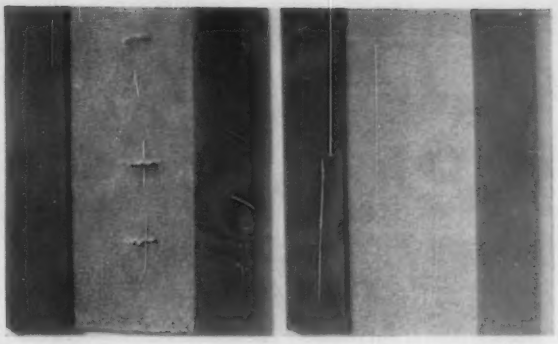
belt end flop and catch on something with resulting tear. Manufacturer can avoid this through better carcass design.

(3) Poorly applied fasteners working loose and starting a tear. More care will eliminate this possibility.

(4) Lumps of material passing between pulley and belt at splice, invariably causing "local" damage to the fastener nearest the "lump." Operator should locate shields and "plows" where necessary to prevent this.



CONVEYOR STRUCTURE affects belt life and must be maintained in good condition. This pulley, with fins and support bent in jam up, causes belt to run crooked and off idler.



FOUR-PLY BELT with one ply able to stretch only 3% less than other three, developed carcass breaks due to impact after only 1/20th the service of a balanced belt of same type.

Use of proper belt carcass is an additional safety factor against this type of failure.

3. Carcass Failures fall into three categories:

a. Excessive stretch, which can be an effect of:

(1) Improperly processed belt during manufacture. Manufacturers are now using greater care and control in their processes.

(2) Rayon getting wet. If tension requires the high strength of rayon, frequent inspection of covers for cuts and tears followed by patching will retard moisture penetration.

(3) Overstressing. Closer cooperation between user and manufacturer will prevent use of too light a belt for the job.

(4) Insufficient take-up. Such a condition can result in a perfectly normal belt causing trouble. Following manufacturer's recommended take-up will prevent this. Supplying the manufacturer with take-up data when it is to be below normal range will enable him to take special precautions to meet this condition.

b. Longitudinal breaks and tears, possibly due to:

(1) Insufficient transverse strength. This can be avoided by purchasing a belt which has the manufacturer's recommended minimum number of plies.

(2) Insufficient lateral stiffness, which can cause excessive flexing at point where flat and troughed idler meet. Use of minimum plies recommended by manufacturer will also generally prevent such trouble.

(3) Impact loading conditions causing carcass breaks. The manufacturer can help avoid such failure through use of special carcass design features such as breaker fabric, cushions and high impact resistant fabrics with nylon in the filling. The operator can use impact idlers and in some cases can redesign his loading set-up to reduce the total effect.

(4) Excessive tension combined with impact loading, which can cause a belt to split near center of the loading area. Prevention of excess tension is a must on impact loading conditions; special pulley lagging (herringbone design) may be necessary to overcome slippage when wet operating conditions are present.

(5) Cutting, generally caused by some sharp material jamming against surface of belt. Proper guides and guards can help prevent material lodging in spots that could cause cutting.

(6) Rotting of fabric when water enters carcass through small cuts in cover or breaks in the rubber edges. Inspection and repair is part of the answer. Mildew inhibitors are commonly used to retard such troubles. Nylon filled fabrics will prevent longitudinal tears from this cause.

c. Transverse breaks probably rep-

(*Continued on p 94*)

Manufacturing Controls Are Key to Eliminating Two Failure Factors

The selection of proper fabric design is a relatively easy task compared to the manufacturing steps that must be taken to insure that unbalanced stresses (uneven stretch characteristics between plies) are not present in the finished belt.

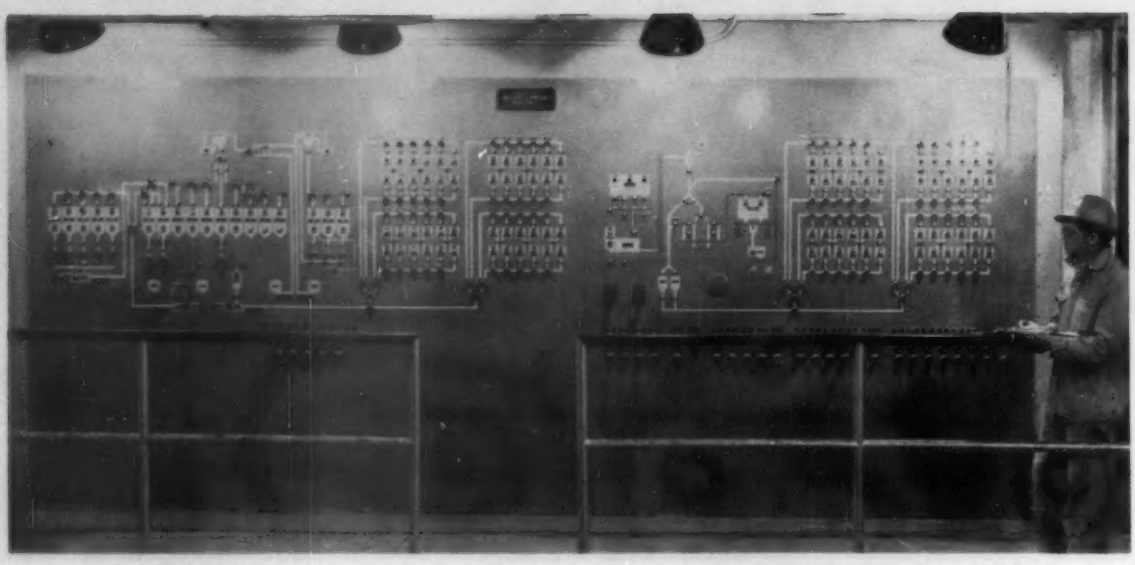
There are six normal steps in the manufacture of a conveyor belt and each has its own effect on the stretch characteristics of the belt plies and hence can contribute to an unbalanced belt carcass.

Concentrated research over the past 3½ years involving complete processing controls and stress-strain tests on 1,296 full production belts conclusively proved that balanced belt carcass can only be obtained if very close tension control is maintained over the fabric during the frictioning and skimming operations.

To appreciate this better, we have only to observe the normal tensioning routine which consists of hand tightening a "slip" (friction) clutch, the standard equipment on today's frictioning and skimming machinery. The operator's usual procedure, to keep the fabric from buckling as it goes through the rubberizing processes, are to make frequent tension adjustments by hand from start to finish of the roll of fabric. Under this normal method of tension control, variations of as much as 100% in stretching have occurred between one spot and another in the same roll of fabric. Obviously, it is next to impossible to make balanced belt carcasses with fabric that has been handled by the normal procedures that can create such widely varying stretch characteristics.

To insure even tension and hence uniform stretch characteristics, it has been found necessary to go to elaborate electronically controlled tensioning equipment on the calenders used for frictioning and skimming. Furthermore, very close control over the rubber component used for frictioning is necessary to insure proper coating with uniform squeeze pressure. This, combined with uniform tension control, guarantees uniformly stretched and tensioned fabric going into balanced ply belts. Tests on 302 production belts made under fully controlled procedures showed a 43.5% improvement in the impact and shock-absorbing characteristics as compared to less rigidly controlled belts.

Operators can look for a noticeable reduction in premature failures in their belt carcasses as these revolutionary manufacturing methods become more widely used.



MAIN CONTROL PANEL, where one man can regulate unloading, storing and transfer of all additives from the additive plant to the pelletizing plant. Materials handled include soda ash, coal and bentonite required in processing.

Pneumatic Conveying Solves Taconite Processing Problems

MATERIALS HANDLING of taconite concentrates and additives presented special problems at the largest taconite pelletizing plant on the Mesabi Range. Two additives, bentonite and soda ash, proved troublesome in their own way because they are hygroscopic, and tend to become sticky when exposed to humid air for any length of time.

Consequently all handling of the two additives, as well as pulverized coal, was assigned to pneumatic systems. One man at a centralized panel controls the many fluidizing conveyors and all their component parts.

This automatic, remote panel serves two major purposes in addition to actual control; it indicates graphically, by flow lights, the path each material is taking at every moment; and, by a complex system of interlocks, it prevents human error from causing an operational mishap.

Controlled by the panel are four separate pneumatic systems and their components. The systems are used for conveying the various additives from their arrival at the plant to storage and from storage to process. All pneumatic handling equipment, including the control panel, was engineered and manufactured by Fuller Co., Catasauqua, Pa. to handle the job.

The terms "Airslide" and "Airveyor" are trademarks of Fuller Co., Catasauqua, Pa.

There are two buildings involved at the plant in the actual pelletizing of the iron ore. One is the additive building, and next to it is the pelletizing plant. Nearby are exterior storage silos for the bentonite and soda ash. See illustration.

Both materials arrive in weather-sealed "Airslide" cars on one of two tracks which run through a covered unloading zone attached directly to the additive building. There are two unloading stations here, one serving a Fuller-Kinyon system for transferring bentonite either to the outside silos or to in-plant silos, and the other is part of an "Airveyor" system for handling the soda ash.

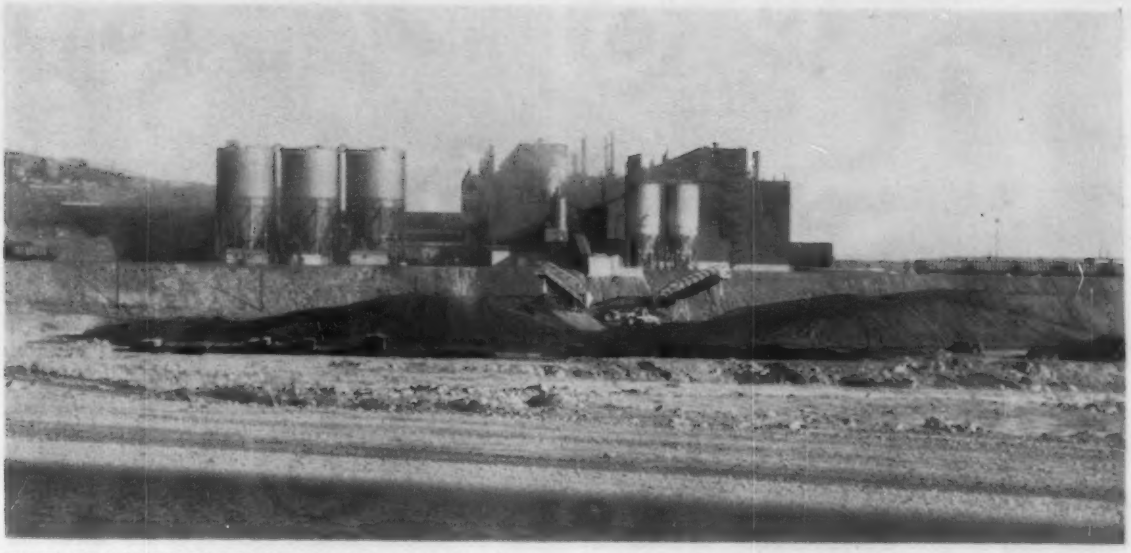
When a car, containing 140,000 lb of bentonite, pulls up at the first unloading spot, an underground chute is opened and a flexible car connection attached. The material discharges into a 30-ft long Airslide fluidizing conveyor which feeds directly into the hopper of a Fuller-Kinyon pump.

This conveyor is designed to handle finely-powdered material. It actually floats the powdered bentonite on a "belt" of low-pressure air. The conveying duct consists of parallel upper and lower chambers separated by an air-permeable diaphragm. Air under low pressure, which is passed from the lower chamber through the special diaphragm, partially fluidizes the bentonite and gives it the characteristics of a liquid so that it flows under the force of gravity to the pump hopper.

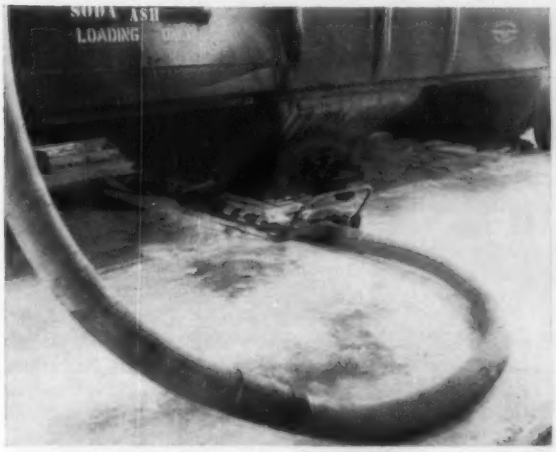
Pump used with the Fuller-Kinyon system is a 7-in. H2 stationary pump with a 60-hp motor. The bentonite advances through the barrel of the pump where it is compacted—to prevent blow-back—by a decreasing pitch of the impeller screw flights and a variable space provided between the last flight and a check valve.

The material then enters a mixing chamber, through the check valve, where the material is fluidized by compressed air introduced through a series of air jets and in this fluid state it is advanced through the pipeline at a capacity of 35 tph for a distance of up to 600 ft to any one of the three outside bentonite silos. The silos have a total capacity of 8-million lb. Air supply is a self-cooled rotary compressor.

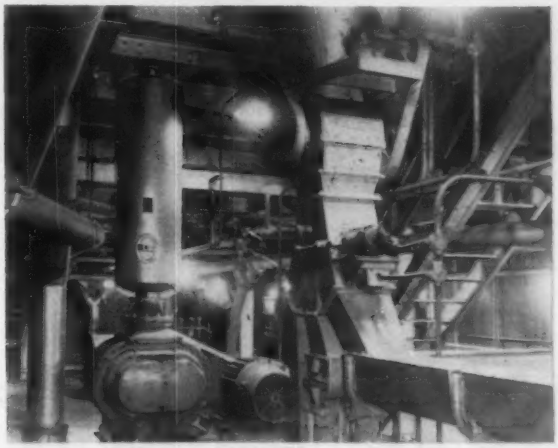
A special branch line enables transfer directly, by means of a motorized diverting valve, to one of two bentonite silos right in the additive building. The diverting valve is controlled from the one central panel. Metering devices linked to the panel help it do much of the "thinking" required. Flow of incoming material from one



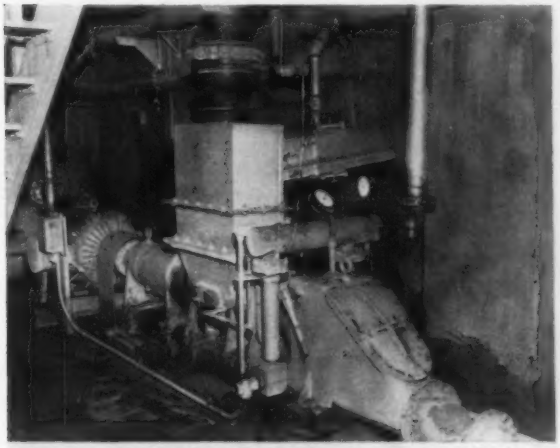
PART OF LARGE TACONITE PLANT on Mesabi Range. Three outside storage silos for bentonite are at left; two for soda ash are in center. The additive building is directly behind the soda ash silos. Control center is in this building.



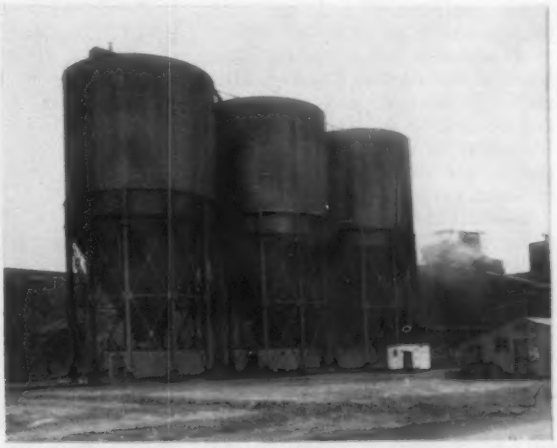
SODA ASH CAR with pneumatic loader in place. Connecting the hose is the only manual labor involved in this operation.



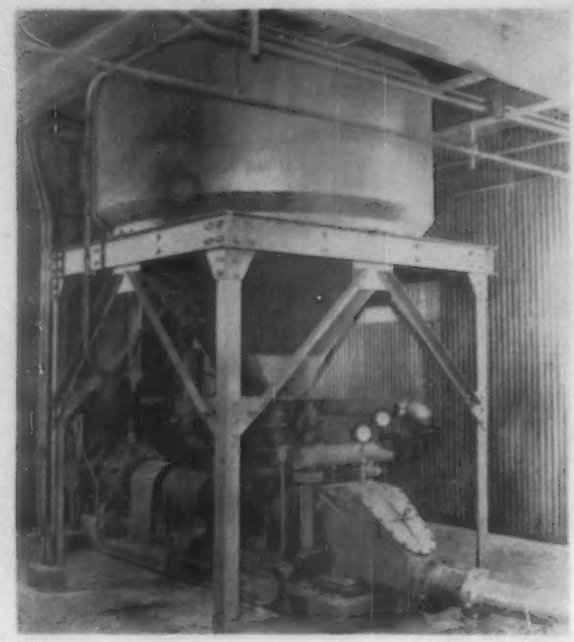
DISTRIBUTING SCREW CONVEYOR from Airveyor filter unloads soda ash directly from incoming railroad cars.

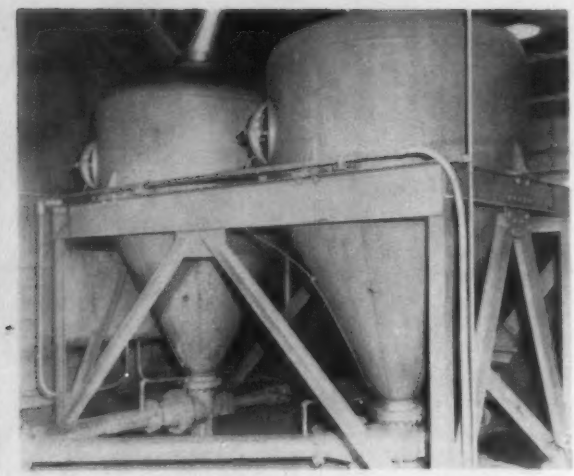


PUMP, FED BY AIRSLIDE CONVEYOR from second unloading station, delivers bentonite (right) to outside storage.



LARGE QUANTITIES OF BENTONITE required as additive in the pelletizing process are stored in these outside silos.





DUAL-TANK FLUXING SYSTEM conveys pulverized coal from the dryer to any one of 24 furnace bins in the pelletizing plant.

PUMP TRANSFERS MIXTURE of soda ash and bentonite from inside process bins to furnace feed bins—about 600 ft.

bin to the next occurs automatically when a "high-level" indicator is tripped. All told, there are 75 of these bin signals through the plant, and 55 of the two-way motorized valves.

Suction System Used for Soda Ash

Incoming cars, loaded with 100,000 to 110,000 lb of soda ash, are spotted at the second unloading station. An operator simply connects a conveying line to the car outlet, and the rest of the unloading into the two outside storage silos (with a capacity of 1,333,000 lb each) is underway. A suction-type Airveyor system was used to handle the soda ash, as that material has a tendency to pack and bunch up, causing it to stick.

A second Airveyor system is centered in the additive building, above the collection of process bins, and can be used to unload directly from the incoming cars and reclaim from the outside storage silos. Suction is provided by an exhauster.

To reclaim bentonite from outside storage silos to process bins in the additive building, on the other hand, a pumping system is used. In an enclosed passageway beneath the silos, a 7-in. portable Fuller-Kinyon pump rides on a track. Easily connected, in turn, to the discharge spouts of the three overhead silos, it pumps the bentonite directly to one of two process bins at a capacity up to 1,600 lb per minute. Air here is also provided by a self-cooled rotary compressor.

Except for the powdered coal, the additives are now in place for processing. The purpose of this operation is to agglomerate, or pelletize, the iron ore which has been extracted from the taconite and pulverized to the point where it would blow away if left exposed in open cars or stockpiles. Bentonite acts as the binder and gives it body, and soda ash aids dispersion of the bentonite.

For the pelletizing process, the two additives are first blended together in the additive building and metered to a paddle mixer. From this mixer, the materials enter another pneumatic conveying system for delivery to any one of 24 service furnace feed bins in the pelletizing plant. Distance is up to 500 ft and transfer is at a capacity of 35 tph.

At the pelletizing plant, the blend is mixed with the iron ore concentrates and coal and fired at 2400° F in shaft furnaces to produce a hard, dense pellet suitable to stand the rigors of shipment to steel plants.

Coal-Handling System

The fine anthracite coal is brought by conveyor belt to a grinding circuit, and then dried. From the dryer, the pulverized coal is introduced into either of the tanks of a No. 185 dual tank Fuller-Fluxo conveying system located just inside the additive building. In this system, the tank feed cutoff valve closes automatically when the blowtank vessel has received a full charge of material.

A predetermined timing cycle permits air to enter the vessel at the proper time through an aeration ring located near the vessel line and an air valve located at the bottom of the cone. The combined air released into the vessel builds up sufficient pressure to eject the feed into and through the conveying line to destination.

The destination, 24 furnace feed bins, are up to 600 ft away. Coal is conveyed to them at a capacity of 30 tph. Again, a system of high-level bin indicators and motorized diverting valves, sending information back to the main panel, automatically controls the entire operation.

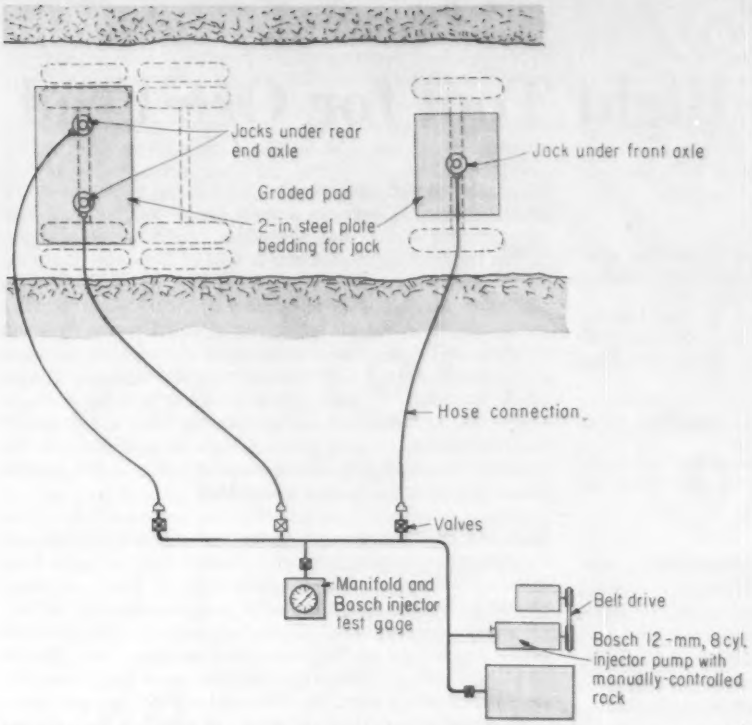
Avoiding Belt Failure

(*Continued from p 91*)

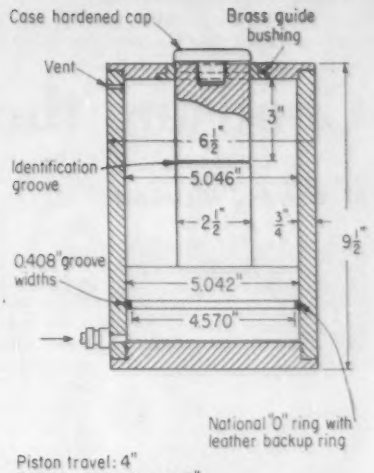
resent the greatest single cause of premature belt failure, and as such have been receiving a great deal of attention from belt manufacturers. The same things that contribute to fastener and longitudinal failures—overstressing, undersized pulleys, material getting between belt and pulley, impact and mildewing—also cause transverse failures; but the more important factors are probably:

(1) Insufficient elasticity
(2) Unbalanced plies

The last two interrelated deficiencies cut a belt's actual strength 40% and its normal ability to absorb impact, momentary shock stresses and the usual minor abuses by 50% (see photo above). They can only be corrected by proper fabric design and manufacturing procedures (see below).


Jacks under rear end axle
Jack under front axle
Graded pad
2-in. steel plate bedding for jack
Hose connection
Valves
Manifold and Bosch injector test gage
Belt drive
Bosch 12-mm, 8 cyl. injector pump with manually-controlled rack

MAIN FEATURE of the new weigher is that there is less chance for error—jacks lift trucks as single units, not one wheel at a time as other systems had done.



JACK CYLINDER has a 20 sq in. cross-section. Therefore, for tons, operator reads gage two decimals to the left.

Jacks Quickly Weigh Trucks

A SIMPLE, YET VERY ACCURATE truck weighing system, developed at Inspiration Consolidated Copper Co.'s open pit, Inspiration, Ariz., has done away with a major mine owner headache.

Some "portable" weighing units are actually heavier than the equipment they're called upon to register. Therefore, aside from steep initial costs, there's the problem of both moving the weigher and of bedding it securely on solid level. In addition to all this, the units are usually designed to weigh the truck on a one-wheel-at-a-time basis. If the operator is at all careless during any part of the weighing operation, the weight range for the separate wheels may be great enough to give a total that would make the 15-minute project seem like a waste of time.

The weigher's parts, (all made from scrap material in the pit shops) include three hydraulic jacks, a pump assembly serving them through pipelines, and hose connections made up of a Bosch 12-mm, 8-cylinder fuel injection pump with manually controlled rack and driven by a 15-hp gasoline engine. Load reactions are read from a Bosch injector tester gage equipped with a Blackhawk V-9 choker to prevent the pointer from snapping. Plates of 2-in. steel leveled into the weighing pad give proper bedding for the three hydraulic jacks.

The jack cylinder is extra heavy steel pipe—interior wall is carefully machined to a 20 sq in. cross-section. This houses the steel piston which in turn has two rings (one National "O" and one leather).

DESIGNER C. R. ZACHE, garage foreman, built the system in the Inspiration pit shops, using only scrap parts.

For the actual weighing, Inspiration follows one of two methods—one series of operations for single rear axle trucks, and another for double rear axle models. During either of the two operations, trucks are rolled onto the pad, jacked up, weighed, and driven away in 15 minutes.

When working on single rear axle trucks, the operators place one of the hydraulic jacks under the front axle and put the other two at each end of the rear. As the jacks force up to maximum height, their pressures are transmitted to the gages, registered and recorded.

Double rear axle trucks must be "set up" before being jacked up. Crewmen do this by first placing boards between the top of the end rear axle and the bottom of the truck body. They then roll the hauler forward and position the end rear axles atop flat-lying boards. The front rears now hang free and the crew handles the truck as if it were a single rear axle type.

During either of the two weighing schemes, there's no problem to convert gage-indicated pressures into tons. Since the interior cylinder area is 20 sq in., gage figures are read to two decimal points. For instance, in weighing a Dart 300 truck (empty), the weight supported by the front axle jack was 1,060 lb and those on each side of the rear axle were 950 and 800 lb, giving a total of 2,810 lb. The truck's total weight therefore, was 28.1 tons.

Choosing the Right Tool for Ore Feed

W. EDWARD MILLIGAN

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He served in the USAAF from 1942 to 1947 and was stationed in Africa and England.

Mr. Milligan is a member of the Providence Engineering Society.

The following article is based on a talk prepared by the author.

SIMPLE, ACCURATE BULK FEEDING and proportioning systems must be designed to keep pace with research and development in the various beneficiation processes. If maximum benefit is to be gotten from these processes, blending system precision in the mill should approach that of the laboratory. With this in mind, let us now examine the basic elements of a practical feeder system.

Choosing the Correct Feeder

Some of the important factors that affect choice of feeders are the material characteristics of the solid or solids with which we're working. These characteristics fall into the following main types: physical, flow, and storage.

Physical Characteristics. Shape, one of the key properties, is divided into three basic forms: (a) corpuscular or granular materials, including the clays, powders, crystal spheres; (b) laminar materials which tend to have flat shapes, such as flakes, chips; (c) fibrilla or fibrous materials, such as tobacco shavings, natural fibers, etc.

Size distribution is the second important physical characteristic. This has an effect on flowing characteristics and gate size as well as storage problems; particularly for granular materials. Too wide a size distribution can cause bridging or packing in the bins if vibrated. This material will also tend to classify if handled through vibratory feeders. As a rule of thumb, the more uniform the material the more flowable it will be.

Hygroscopic quality is a material's third important physical characteristic. Hygroscopic is perhaps too general a word to use because it is an adjective describing the nature of the material when it is exposed to moisture in the air. We are interested in the specific properties, such as cake-up in which a material will pick up enough moisture in the air to cake, or deliquescence, in which a crystal will pick up enough moisture from the air to eventually dissolve itself.

Fortunately, most of the materials we handle are hard crystals and clays which will adsorb moisture and not tend to cake up. Our chief difficulty arises from soft crystals which have a natural tendency to combine to reduce their total surface. Furthermore, there are accurate feeders available for handling almost any hygroscopic material.

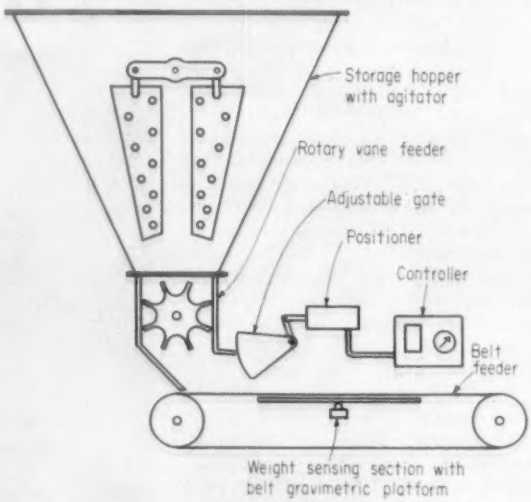
Flow Characteristics. Many free flowing materials, such as dry sand, behave as a fluid—the individual particles tend to maintain their independence and the material will flow through an orifice in a steady flow rate. The material can be readily stored and usually requires no agitation or vibration. Since it behaves almost like a fluid, it will flow through any orifice and, therefore, feeders must be tight.

The more difficult problem is that of floodable material, which is usually a powder material that will arch in a bin and allow an air pocket to develop below it. When the arch collapses, the material, falling through the space, becomes fluidized in air. It then behaves much as a rushing fluid and will literally swamp a feeder and pass through any gate or crack available. In contrast to the free-flowing material where the particles tend to move as individuals, a floodable material will move as a mass. A valve or gate prevents the flooding or swamping which usually starts in the hopper where the material is least controlled.

Storage Characteristics. The effects of size distribution and the hygroscopic qualities upon storage have already been discussed. Two additional characteristics must be mentioned: adhesion, where material hangs to the wall or side of a bin and cohesion, where the particles cling to each other and cause arching and hang-up in a bin. Before tackling feeding problems, operators must determine the material's storage characteristics and critical storage times.

An important part of the feed problem has been passed over rather lightly and quickly. However, there are two points that must be made: One is that all the factors are relative; the other is that all must be known before a reliable system can be designed.

The B-I-F laboratory contains almost 2,000 samples of customers' materials that have been classified according to their material characteristics, and for which the best types of feeders have been determined. One important outcome of these tests is that we have a great many materials for which four or five tests have been run from different sources with different results. We have thus been able to avoid some serious feeding problems before they develop.



Parts of a Standard System

Once the characteristics of the material are known, we can take a look at what will be required for a satisfactory feeding system. There are four elements: A proper storage

facility at the feeder; a feeder mechanism to remove the material from storage; equally important, a means of varying the feed rate; and, if any accuracy is to be gotten at all, a method for checking and controlling the feed rate.

One type basic system (figure, p 96) contains a belt feeder with an adjustable gate for varying the feed rate and a belt gravimetric platform as a means of actually weighing and controlling the weight or the rate of delivery. This includes a weight sensing section, a controller, and, through the controller, a positioner to adjust the quadrant gate.

Basic Types of Feeders

Feeders fall into the following main types: The gravimetric feeder which feeds by weight; a volumetric feeder which feeds by volume; apron or pan type feeder; and the more sophisticated loss-in-weight feeder.

Let us examine these in order of accuracy.

Feeders for difficult material. Vibratory pan or plate feeder will feed a wide range of materials over a wide range of feed rates, and will respond quickly to a change in command. While it can get into difficulty with floodable materials, it is an excellent tool for the application engineer.

The apron feeder is another good type for handling difficult material. It consists of a series of plates on a moving belt and will drag material out from the bin and deliver it. With a variable speed drive, it responds quickly to changes in command and will handle a wide range of particle sizes and lumps. This is a particularly important feeder for handling sticky, gummy materials. As with the vibrating pan, however, care must be taken when handling floodable materials.

The screw feeder, another important unit in this class, will remove difficult material from a bin and keep it in an enclosed area, not exposed to the atmosphere. It, too, can respond to an increase or decrease signal.

Though all feeders in this classification handle difficult materials at varying rates of feed and are excellent tools to use as part of a feeding system, they are, in general, unsatisfactory for handling floodable materials.

Volumetric Feeder. First in the line of volumetric feeders is the Rotolock or star feeder which consists of a rotating star wheel in an enclosure. In actual practice, a great deal of variation exists in the design of the star or pocket wheel. This feeder is excellent for handling floodable materials because it acts as a valve as well as a feeder. Flooding, as already mentioned, starts in the bin or storage hopper and the use of a star wheel feeder as a valve can prevent flooding into the feeder mechanism.

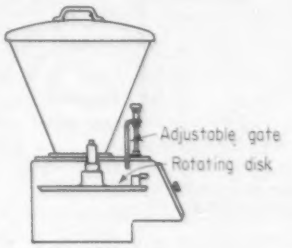
It can be designed with spring-mounted side plates to permit foreign or large particles of material to pass through the rotor without damaging the unit. The use of the spring plates also helps to maintain a seal against the rotor.

There are many possible variations in this feeder. It may be equipped with a pocket scraper which, in effect, rides in the pocket and continually cleans it with each passage.

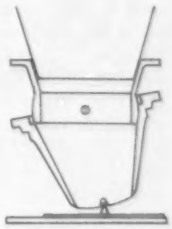
The discharge rate of this feeder tends to be a bit uneven because of pockets emptying irregularly, but when a more uniform delivery rate is required, a bevel plate is added at the bottom of the rotor to hold back the material in the pocket and permit a more uniform discharge.

There are two important applications for the Rotolock type of feeder; one is in handling floodable material where the Rotolock acts as a valve to prevent flooding; another is in a straight volumetric feed when the Rotolock has an open discharge. In general, it is not good for a very fine, free flowing material.

Another type of volumetric feeder is the rotating disk or table feeder. In essence, this is a rotating disk which supports a major part of the load and rotates against a fixed plow which shears the material from the table. It is a true volumetric feeder in that it has a controlled ribbon with a variable feed rate, or speed of rotation. In effect, it slices a ribbon of material from the rotating disk. The table feeder is usually used for high feed rates, or very heavy materials. It is ideal for handling sticky, or non-flowing type of material.



Disk Feeder



Volumetric Feeder
Oscillating Throat Type

The disk feeder is closely aligned to the table feeder and used for lighter materials and smaller delivery rates. It is a small feeder with a small rotating disk and the dosage or percentage of feed is usually set by adjusting a gate. Depth of the ribbon and the actual feed rate will vary with the speed of the disk.

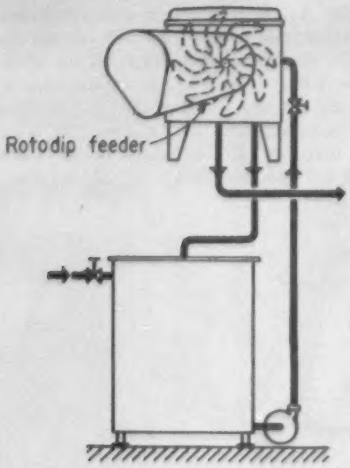
There is one very important difference between the small disk feeder and the heavy table feeder. The table feeder usually supports a large load with the result that the material on the disk is actually under pressure from the load of material in the bin. In the smaller disk feeder, the bin and the disk are eccentric, so that a natural scroll is developed as the rotating disk moves. The scroll is an increasing reliet to the material as it passes around the periphery of the disk, until it passes out under the gate and is plowed off the end. This is an important feature for accuracy of a volumetric feeder. It gives an opportunity to "condition" the material by relieving the pressure from above. The material reaches a normal bulk density before it reaches the gate and is plowed from the disk.

One version of the disk feeder has a grooved disk and is flush with the table. This, too, rotates with a scroll design to "condition" the material by relieving it from its overhead pressure. The feeder has a precision lapped scraper or plow that enters the groove at the discharge point and literally plows the material out and off the side of the disk. The unit is used for low feed rates and particularly high accuracy with very uniform material.

The table and disk feeders are the same in one respect. The engineer must be very careful in choosing such a feeder for floodable material.

The oscillating throat or universal feeder also handles relatively free-flowing substances. Material is supported on a tray fed from an oscillating throat which, via a scraper, continuously plows material alternately from one end of the tray and then the other. The throat oscillates and the keyway at the foot of the throat moves a scraper back and forth. This is a particularly simple feeder with small moving parts, providing a uniform delivery rate. It permits a wide range of feed rates by having two variables; the thickness of the material on the tray and the amount of travel of the oscillating throat.

Another feeder, more particularly adaptable to handling slurries, is the paddle wheel or Rotodip type and consists of a series of formed buckets rotating on a shaft in a tank. For slurry applications, the tank will contain an agitator to maintain suspension. With most slurries it also operates on



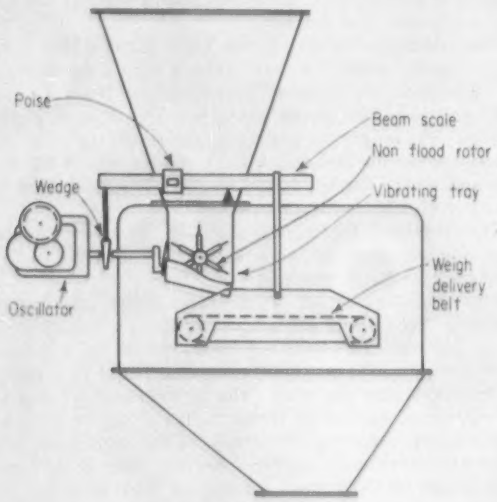
Rotodip Recycle Circuit

a recycle circuit also in order to maintain the suspension.

The discharge of this feeder is particularly uniform over a wide range of speeds and, as shown on the sketch, occurs at the center of the wheel. It is extremely accurate as a volumetric feeder for both liquids and slurries, with repeatable accuracy maintained within 1% of the set feed rate.

Gravimetric Feeders. All of the volumetric feeders mentioned have accuracies of at best 1%. This is because of varying bulk densities as the material flows through the machine or through the hopper. The grooved disk feeder and the Rotodip are the two which come closest to actual feeding accuracy. Since all of the formulas which we use in processing operations involve weight or mass of material rather than volume, accuracy in the operation will be gotten if gravimetric feeding and blending are considered.

The gravimetric feeder utilizes a belt as a combination feeder and weigher. It also has a controller and a bulk or volumetric type feeder ahead of the weigh-delivery belt.



There are two distinct philosophies of design in this type of feeder. In one, the feeder is designed so that the entire delivery belt is suspended on a scale and becomes a weighing unit. In the other, the belt and drive are fixed and a portion of the belt is used as a weigh platform; or for larger feeders and larger capacities, a short section of conveyor is used with idlers and one of the idlers isolated from the structure and supported by a weight transducer.

There are also two methods of control in the gravimetric feeders. In one, weight of material on the belt is controlled, keeping it uniform and varying the belt speed. In the other, the belt speed is maintained at a constant value and the load on the belt is varied with the rate.

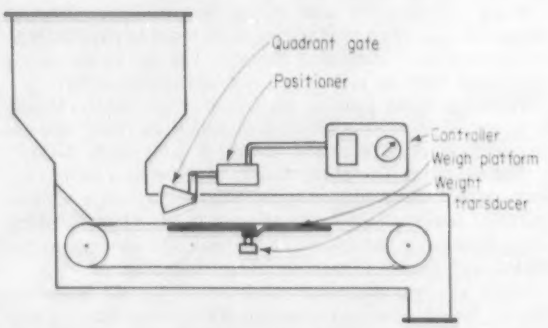
In the suspended weigh belt design, the load per foot of belt, or the load on the weigh platform is set by positioning the poise along the beam. This feeder satisfies the other requirements of a workable system in that there is a receiving hopper, a feeder, a rotating star wheel to remove material from the hopper, and a vibrating tray-type feeder to deliver the material to the belt. It is an example of a very simple mechanical controller—an oscillator which transmits vibration to the vibrating tray via a paper wedge.

The paper wedge is suspended from the end of the scale beam. The oscillator is driven at a constant speed and the amplitude of the vibrations on the tray varied by the position of the tapered control wedge. Position of the control wedge also varies directly as the over- or under-weight of the material on the weigh belt. The scale beam recognizes the difference in weight between the poise setting and the weight actually on the delivery belt. By moving the tapered wedge either up or down with the beam, it changes the amplitude of the variations of the feeding tray and returns the beam to the neutral position.

The delivery rate of the feeder is varied by varying the belt speed. In this particular design, the rotating star wheel also varies directly with belt speed so that the feeder never starves itself. This particular feeder must be tuned by adjusting the length of the oscillator rod so that the feeder can come into control with the beam in a balanced position. Once it has been tuned to a particular material the feeder performs well.

There is one disadvantage of any belt gravimetric feeder —the problem of drop-off or slough-off at the end of the belt. Many materials will have irregular slough-off characteristics and will prevent a uniform delivery rate. This difficulty is most important in the suspended belt type of feeder because the regular discharge is changing the total weight on the belt and forcing the system to hunt more than it otherwise would.

The particular gravimetric feeder that has been described is an excellent example of close coupling. The minute the material leaves the vibrating tray it is on the delivery weigh belt and is sensed by the weigh unit—there is no time delay between a change in feed rate at the feed tray and its being sensed by the controller, in this case the weigh beam.



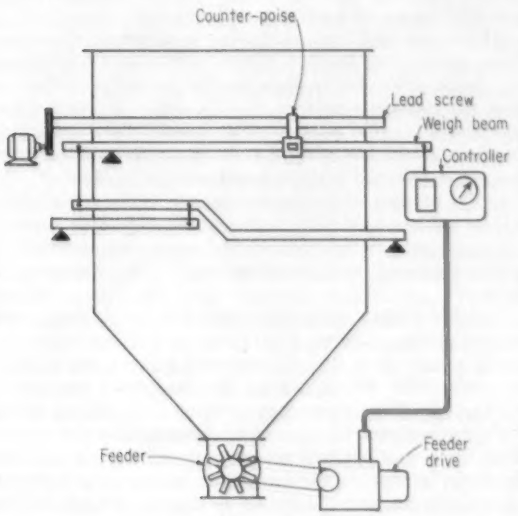
In this second idea of belt gravimetric feeding, the belt and drive are part of the structure, and a section of the belt is supported on a weigh platform which in turn is sup-

ported by a weight transducer. Here again, there is close coupling because the controller now is the quadrant gate shown on the sketch, and the minute the material leaves the control of the quadrant gate it is on the weigh platform and being sensed by the weigh transducer.

This type of belt gravimetric feeder also contains all of the elements needed for a satisfactory feeder system. It contains the feed hopper, a means of removing the material from the hopper, in this case an open chute delivering to the belt; a means of controlling the feed rate, a positioner and a quadrant gate which will adjust the load ribbon. A weigh transducer or weigh cell which measures the actual weight and pounds per foot of belt will check and control. This particular feeder also can have two systems of control. A weigh cell may maintain the pound per foot weight on the belt and vary the belt speed for delivery; or the belt speed may be kept constant and the load varied on the belt in pounds per foot.

All of the mentioned gravimetric feeders have departed from a simple feeder and have gained a refinement of sending element and feed back. We are departing from feeders and approaching feeding systems. The result is that accuracies of 0.5% have been obtained without difficulty, and that we are a step closer to the laboratory.

Loss-in-Weight Systems. This report started out with the basic pan type of feeder, then continually stepped up the feed back and increased the feeder control. It then passed through the volumetric, then to the gravimetric with a 0.5% accuracy and will now discuss the most sophisticated feeder—loss-in-weight.



The loss-in-weight system consists of taking the material hopper and all of the feeding equipment, supporting it on a scale and forcing the entire system to lose weight at a given rate. This is accomplished by taring out the weight of the hopper, material and feeder via a counterpoise positioned on a weigh beam. The system is forced to lose weight by moving the poise via a precision lead screw. The lead screw is a precisioned screw driven by either a synchronous constant speed motor or a precisioned servo, if variable rate is desired. The relative over- or under-weight of the hopper, as compared to what it should be, (which is determined by the position of the poise along the screw) acts via a controller to change the delivery rate.

The one most important feature of the loss-in-weight system is that it has a built-in memory. Any of the other systems are subject to upset that will leave the system forever out of step. Since the poise of the loss-in-weight system is continually moving with time then the position of the poise along the beam is a memory and the system cannot go either ahead or behind the process. The result is a much finer, closer control that permits accuracies of ¼% and better. The addition of the memory device converts a feeder into a complete feeding system.

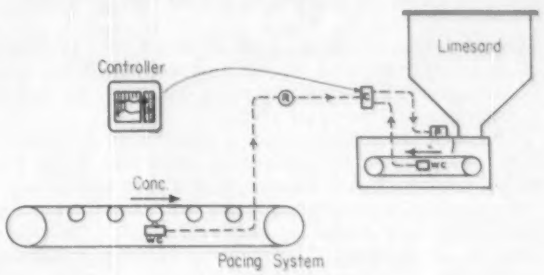
A simple reversal of the loss-in-weight feeder makes it a gain-in-weight. A duplex unit can be developed, using a large storage hopper with a split delivery and two small low-cost continuous loss-in-weight feeders. One feeder would utilize gain-in-weight control of the feed from the large hopper to its delivery hopper, while the other is using loss-in-weight feed from the delivery hopper to the process. Since the two lead screws have a common drive, the travel can be interlocked so that the duplex unit acts as a continuous operation. One half of the system is delivering while the other half is receiving, and at the end of the poise travel the system reverses and the first half receives material while the second half delivers.

To repeat, the two most important features of the loss-in-weight system are its memory, which will not permit it to run ahead or behind the demand of the process and the extreme accuracy with which it will function even over a short period.

The accuracy of the belt gravimetric and the loss-in-weight systems both depend upon an accurate and reliable volumetric feeder. The pan types and the volumetric feeders have not been passed over but have been applied in a more sophisticated way. We must still know and solve storage and flow problems, and we must still know how to use all of the tools that are available to us.

Control Systems

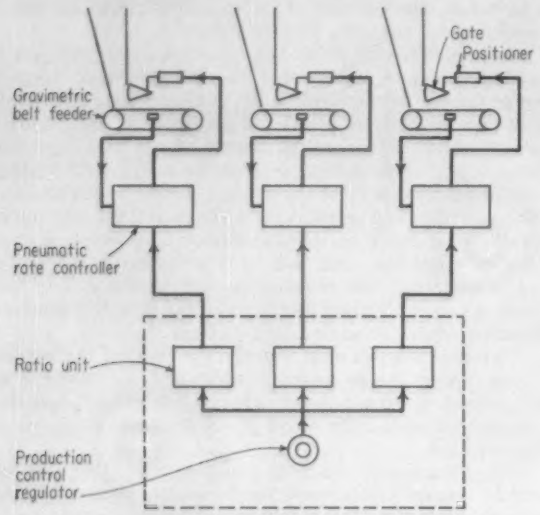
Pacing Systems. The simplest and probably the most common type of control for feeding is a system which paces additive feeders from a varying flow. This may be done either from impulses or from analog signals.



During impulse pacing, the main flow is weighed or measured via a measuring instrument or scale that gives the discrete pulses or impulses for either tons, pounds or any other given increment of weight. These impulses are then used to drive an impulse type meter; for example, a ratchet or Rotolock, or more commonly a diaphragm type pump. This obviously is a very irregular feeding proposition.

The other type of pacing is from the analog signal—using a signal analogous to the weight. Fig. 8 contains a flow of copper concentrate along a conveyor to which we wish to pace the feed of limesand. A weigh cell located in the main stream produces an analog signal either 3-15 psi, 0-5 millivolts, or some such signal which is then transmitted as a set rate signal to the additive feeder via a ratio unit. The ratio unit enables a proportion or formula to be set. The initial weigh cell would issue an analog signal through the

ratio unit to a controller which compares its analog request signal with the actual delivery rate of its feeder from the weigh cell located under the weigh span in the belt. The output of the controller is then used to position a quadrant gate to maintain the requested delivery rate.

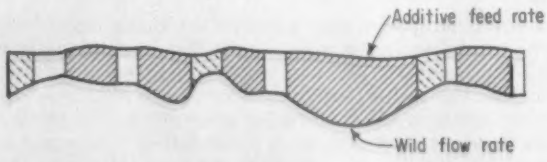


Blending System. Here, in contrast to the pacing system, both materials have a fixed feed rate. Three different materials are blending at a fixed formula. The production control regulator feeds three pneumatic rate controllers via ratio units. A formula is established by setting the ratio. Pneumatic rate controller then compares the actual delivery rate as measured by the weigh cell in the gravimetric belt with the command signal from its ratio unit and its output trims a positioner on a quadrant gate in order to trim the load on the belt to maintain the requested delivery rate. This blending system may be either volumetric via a disk type feeder, or gravimetric via the belt gravimetric.

Close Coupling. One of the most important design features of an accurate blending system is close coupling the controller—getting the sensing element as close to the feeder in time and distance as possible.

The suspended belt gravimetric feeder is an example of close coupling and its importance. With this design the weight sensing element, the belt, is on a scale and the minute a piece of material reaches the belt from the feeding mechanism it is sensed by the weigh cell. This means there is no transport time involved between a particle leaving the feeder mechanism—the gate or rotor—and reaching the weight sensing element.

Close coupling is also one of the important contributions to the impressive accuracy of the loss-in-weight system. It is also an important factor in the accuracy of the belt gravimetric feeder that uses a portion of the belt as the weighing platform, but does not have intermediate idlers. In all of these cases, we are able to minimize the upset by getting immediate response to it.



Being able to immediately respond to an upset is very important in laying out and interlocking a proportional pacing system. It is one of the factors which allows a good application engineer to choose between a gravimetric belt feeder which changes its feed rate by changing the speed of the belt, and one which changes its feed rate by changing the loading of the belt. The system must be laid out and these feeders must be chosen such that the initial element that senses the variable stream is placed in such a manner that for a given increase or decrease in the main stream the additive feeders will deliver a corresponding increase or decrease in material to the same point of the moving belt. All of the feeders, sensing elements and drives must be coordinated so that upsets are kept out of phase with each other.

An example of the importance of being out of phase is shown in the accompanying chart which plots a paced system. The lower curve indicates the wild flow of the initial system and the upper curve shows the additive's actual feed rate. What's being sought is a 12.5% ratio between the two. The feed rates are charted against time—when we started out with an upset in the lower unit we reached the point in the first line where there is a change in condition. At this time, the distance represents the transport lag. As shown up to the first point, the additive feeder was feeding at a uniform rate, but the paced signal was making a change to the high side. At the first point on the graph, increase in the additive rate called for by the increase in the master rate just begins to be felt on the belt. Up to that time we have been lean, as indicated on the graph. Then for a short period of time, while both flows are increasing, we are on-spec as indicated by the clear section of the graph. Once the master flow starts to decrease a bit, the additive flow continues to follow the demand function representing the increase portion of its feed and so we switch from an on-spec to a rich mixture.

These rich and lean conditions continue to chase each other all the way through the system, except for the very few times when the formula is actually on-spec. The only time the system is on-spec is when there is either a long continuous change in rate of the master flow so that the additive circuit has a chance to catch up to it, or when there is a sustained period of uniform master flow. If, after a period of time, the operator merely totalized the actual rate of wild flow and the actual delivery rate, or total delivery amount of the additive, he would assume that the system was very accurate. However, it is anything but accurate.

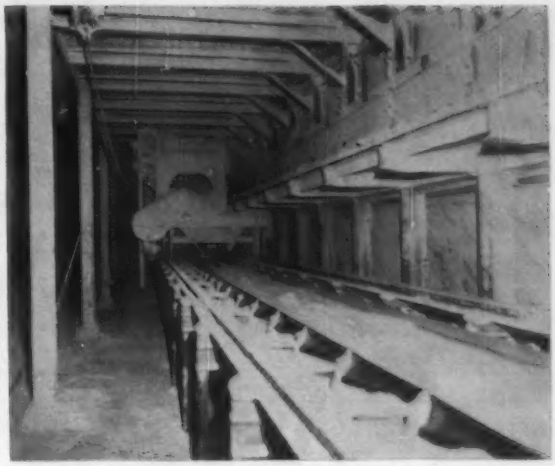
Unfortunately, this is something that the operator could never find out, since he is only able to read total flow as a check on accuracy. This is what will make a mill superintendent wonder whose ore the lab used when they set up the process. The importance of "out-of-phase" in pacing and blending systems cannot be overemphasized—particularly if we start out with a very poor or irregular feeder in the initial stream. If the feeder has an irregular output it is forcing upsets into the system all the way through. If initial feeder is beyond the control of the application engineer, he must interlock his system in such a way that the variations do not get out of phase with each other.

Using What's Here

My purpose has been to describe some of the tools that are available to an engineer in designing an accurate blending and proportioning system, and to review the factors which affect their selection.

The problems faced in designing systems have been rather briefly outlined—I hope they do not seem too formidable. Actually, there is a practical, relatively simple solution to each of the feeding problems. The key to a successful system is good practical application engineering backed up by a knowledge of the materials that are to be handled.

PROPER INSTALLATION of a conveyor belt is exemplified by a roof clear of the danger of rock falls, wide clearances.



THE COUNCIL also recommends care against overloading of the belt, stationing of fire extinguishers along the line.

NSC Recommends Safe Steps For Conveyor Belt Operation

THE NATIONAL SAFETY COUNCIL has recommended procedures for safe planning and operation of underground belt conveyors in Data Sheet D-447. Since underground conveyors involve all the hazards of belt conveyor systems in plants, compounded by their location below ground, injuries resulting from accidents usually are serious—often permanent disabilities and even fatalities result.

The outstanding danger from conveyor belts is fire. Rubber belt fires usually result from friction and from electrical faults. If a rubber belt stalls, a fire can develop at the driving pulley in a matter of seconds and quickly spread along a drift. Burning rubber generates intense heat and large quantities of dense black smoke, making escape and fire fighting difficult. Access to such fires requires the use of breathing apparatus.

Fire from friction may originate anywhere along the belt. It may be caused by:

a) Bearing failures, "frozen" rollers or rollers running hot because of defects and inadequate lubrication.

b) Incorrect tension.

c) Spillage around the idlers and tail pulleys, causing overloading of the belt.

d) A fall of roof onto the belt, producing overloading.

e) Wetting of the belt.

f) Incorrect "training" or aligning and leveling of the belt.

Fire from electrical failures may result from poor insulation, poor cable splicing, and poor grounding. Overheating may result from inadequate capacity in motors, cables, fuses or circuit breakers.

To protect belt conveyors from friction, the National Safety Council recommends that drifts be planned and inspected to prevent rock falls that might clog the belt. On uphill grades stopping a loaded belt will have much the same affect as a rock fall. To prevent uphill overload, it is best to install a ratchet at the driving pulley which will engage when the belt stops and interlock the belt system so that if one section stops, all others stop, and prevent overloading.

Overloading may also result from overflowing transfer chutes. Oliver Iron Mining Div. of U.S. Steel Corp. uses a paddle switch just outside the normal trajectory of the ore. In case of a pile-up in the chute, the belt is stopped as long as pressure is on the paddle. Feeder belts should have automatic stop-start controls at the discharge to prevent overload.

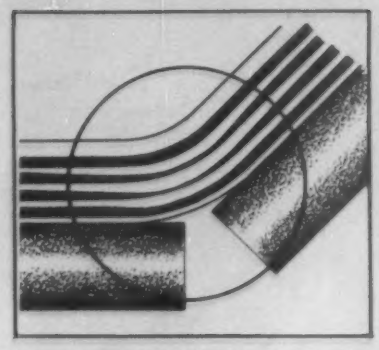
For nearby power lines, says NSC, use fire resistant, rubber covered cable mounted on insulators a safe distance from the belt and from combustible material. The cable should be adequate for the load. Side rollers should be installed to prevent friction on the sides of the belt in narrow passages. Alignment of belts must be checked.

Automatic take-up devices should be installed on belt conveyor systems, or if belts are broken in manually, a conveyor man should make a daily check and adjustment if necessary. Drive pulleys should be shielded by screen or sheet metal shields. Extension grease lines protect workers from being caught in or between rollers when oiling them. Ample clearance is recommended so that miners can work on either side of the belt in safety.

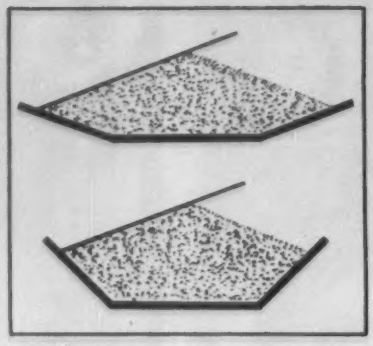
The Council also stresses proper maintenance. Repair torn belts; use perchloroethylene in cleaning belts and beware of low flash point naphthas and carbon tetrachloride. Rollers have a limited life. They should be discarded before they become dangerous. Clean-up around a belt installation is a necessity.

To prevent a fire from spreading, if one starts, install fire extinguishers at critical places along the belt, at driving pulleys, transfer points, and tail pieces. Never use carbon tetrachloride extinguishers underground. It is also advisable to have gas masks for protection against smoke and gases from burning rubber. A sprinkler system and a 2-in. water line with a 1½-in. fire hose should be located in the belt drift.

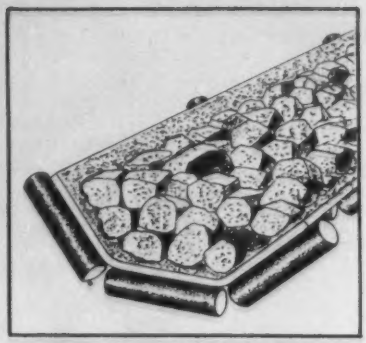
Men should never be allowed to ride conveyor belts, says NSC. Similarly, a conveyor belt should never be started when men are standing near it. Conveyor belt operators should wear tight fitting clothing to prevent being caught and dragged by the belt. Spray systems should be built at discharge points to keep dust down, but never should the belt itself be wetted.



NEW CONSTRUCTION of the special belt resists breaking at the hinge.



ORES have a potential increased capacity of 25% when a 45° belt is used.



BETTER TRAINING is possible with the belt since full contact is made.

New Belt Permits 45° Idlers For Ores

A NEW conveyor belt construction, designed to perform with 45° idlers and handle the same ores and minerals which more conventional belts at 20° now carry, has been introduced. Savings in initial cost, maintenance and downtime are claimed by the manufacturer, Raybestos-Manhattan Inc., who note that the belt is guaranteed against ply separation at the hinge line between side and center rolls on a 45° idler.

Greater carrying capacity is, of course, available on a given width of belt when it is on 45° idlers as opposed to 20°. The manufacturer estimates an increase of 25% capacity for stone and ores. Thus, a narrower conveyor could be employed to handle present tonnage at a mine or mill, or a conveyor with 45° idlers could be constructed at a new property and provide an additional 25% capacity to handle future expansion.

The new belt, called "Ray-Man", is designed to trough readily and resist fatigue from lateral flexing. Its construction is made up of a series of center plies and an envelope which completely wraps around the center. Centers may be of cotton or synthetic fibers; the envelope is nylon warp and nylon fill. Elimination of damage from pinching and full contact with the center roller are said to be basic advantages.

The new belt is not recommended for hot materials at present, but full available data on hot handling may be obtained from the manufacturer, who is conducting performance studies on hot applications of the belt.

Other advantages for the new belt, along with cost, flexibility and improved capacity are as follows:

1. Belt wear is reduced. Conveyor engineers note that the large proportion of cover wear on a properly trained belt is at the loading position. The wear in transit, both on the carrying side and return, will vary with the length of the belt, the material carried, etc., but in all cases the wear at the loading point is generally much greater than at all other spots.

Wear at the loading point is induced by the first layer of ore making contact with the belt. The second layer impinges upon the first and the third layer on the second. The increased capacity of a 45° belt is due to the depth of the load it carries with no increase in the area of contact between belt and load. Since there is less area being struck by the material, less wear results.

2. More effective skirt boards are possible. The steeper the angle of the belt, the less opportunity is presented for material to work out under the skirt board at the loading position.

3. "Beam effect" is increased with the 45° idler, and spillage in transit is reduced.

4. Off center loading, never a desirable development in conveying, has a less pronounced effect when it occurs on a 45° belt than on a 20° idler belt.

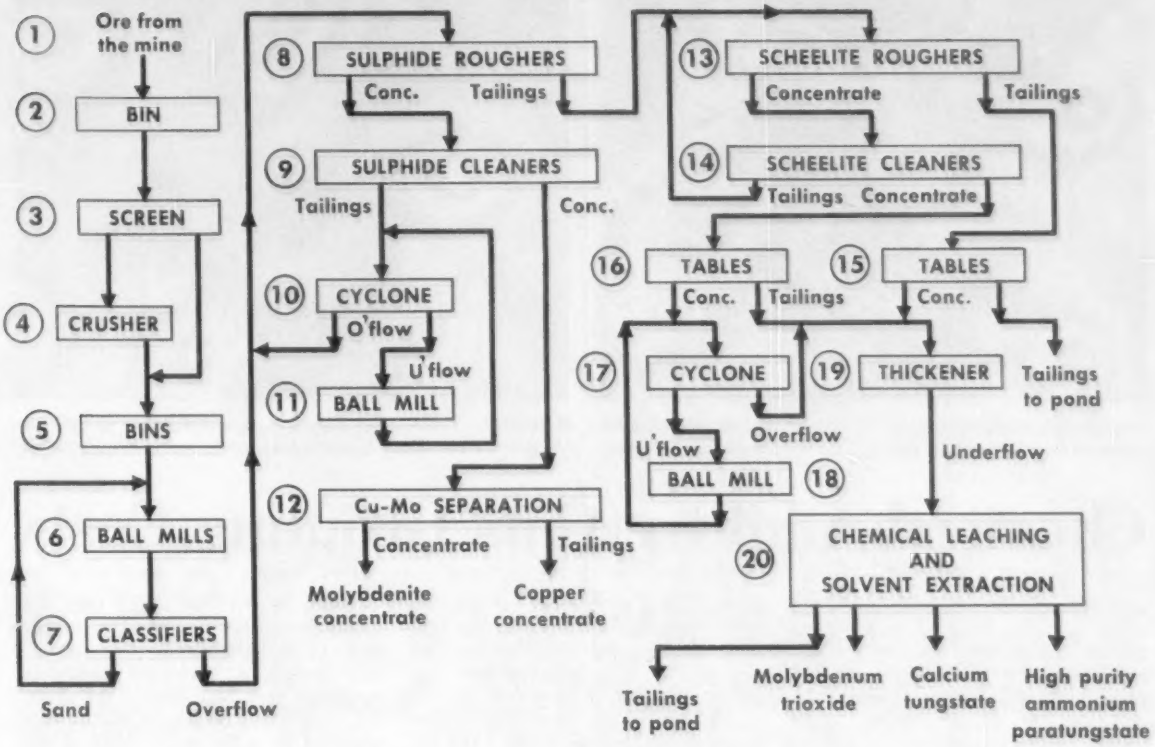
One limitation, other than the hot materials aspect listed by the manufacturer, is that the minimum speed required for proper operation of the belt and for proper trajectory to obtain clearance over the head pulley is 400 fpm.

Comparative Performance 20° and 45° Idler Belts

(Limestone and ores used in tests)

Conventional belt	Width	Feet per minute	Tons per hour	New belt	Width	Feet per minute	Tons per hour
20° Idler	30″	300	539	45°	24″	400	546
		350	629	Idler	—	450	614
	Covers	400	719		Covers	500	682
	1/8 x 1/32				1/8 x 1/32		
		450	809			550	750
20° Idler	36″	300	802	45°	30″	400	899
		350	936	Idler		450	1011
		400	1070			500	1124
		450	1203			550	1235
20° Idler	42″	300	1116	45°	36″	400	1338
		350	1302	Idler		450	1504
		400	1488			500	1671
		450	1674			550	1840
20° Idler	48″	300	1480	45°	42″	400	1727
		350	1727	Idler		450	1974
		400	1974			500	2221
		450	2221				

Tungsten Flowsheet, Union Carbide Nuclear Co. Pine Creek, Calif.



LEGEND

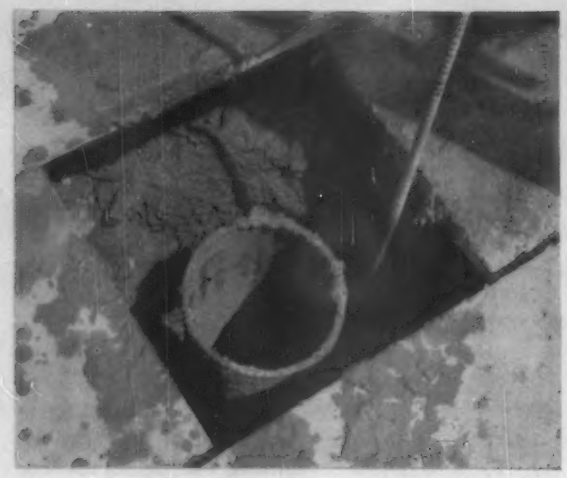
1. Minus 4-in. ore from mine's primary crusher via aerial tramway
2. Wooden bin, 300-ton capacity
3. Symons' 32-in. Rod-Deck vibrating screen ½-in. openings
4. Symons' 5½-ft short-head cone crusher
5. Four 1,000-ton circular steel bins (or to stockpile). Capacity of fine crushing plant is 1,000 tpd (shift)
6. Four 6x5-ft Marcy's low-discharge ball mills, 25 rpm, 7½ tons of 4-in. balls. Each mill grinds 250 tpd at 35% minus 325 mesh. Ball consumption is 1 lb/ton.
7. Four Akins' 54-in. spiral classifiers overflow at 55% solids
8. Four identical rougher sections in parallel. Each has 10 32x32-in. Mineral Separations' cells
9. Seven 32x32-in. Mineral Separations' cleaner cells in parallel. Three-stage cleaning—three cells in first, two in second, two in third. Sulphide concentrate has 20% MoS_2, 20% Cu and 30 oz Ag
10. Dorrclone, 6 in.
11. Stearns Roger's 36-in. ball mill
12. Twenty-two 24x24-in. Mineral Separations' cells. Primary separation, four cells. Six cleaning stages with two cells in each. Six cells in scavenger circuit
13. Four scheelite roughers in parallel, each has 10 32x32-in. Mineral Separations' cells. Each section hog-troughed by holes through cell partitions to form groups of 4-2-2-2 in each of the four sections
14. Two-stage cleaning, three 32x32-in. Mineral Separations' cells in first, one 32x32-in. cell in second
15. Four No. 6 Deister Diagonal-Deck tables recover coarse scheelite from rougher tails
16. Two No. 6 Deister Diagonals recover coarse scheelite from flotation concentrate
17. Dorrclone, 6 in.
18. Denver Equipment Co.'s 36-in. ball mill
19. Thickener, 30-ft dia, handles feed to chemical purification
20. Chemical purification and solvent extraction combine to produce a high grade molybdenum trioxide and a calcium tungstate product for alloy manufacture and a new high-purity ammonium paratungstate.

Union Carbide Changes Bishop Process

TWO ADDITIONAL steps—No. 20 on the flowsheet above—have been added to the process (taken from E&MJ, May 1951, pp 76-83) by Union Carbide Nuclear Co. These steps resulted in another first for the company that developed the first dry cell battery and the first fuel cell—making high purity paratungstate right at the mine (E&MJ, September 1959, p 135).

Process, said to include a solvent extraction step, is the first to prepare a pure tungstate from scheelite ore directly. Final product at Bishop will assay less than 0.003% each of molybdenum and silicon. In addition to the pure material, Union Carbide's chemical section will yield molybdenum trioxide and calcium tungstate products.

Another product is produced when needed for the market at Pine Creek. Note process steps 16-17-18: cleaner concentrate is tabled to produce a high grade 1% Mo natural scheelite which after grinding in the ball mill is sold to market. Normally, the table concentrate is ground in the ball mill, cycloned and rejoined with the table tailings (No. 16) and table concentrate (No. 15) for chemical refining.



STEEL CASING, 10 ft long is embedded with a fast-setting grout to serve as guide for drilling 6-in. holes 100 ft deep.

WELDER secures collar with 3-in. threaded nipple to opening of grout pipe. Pipe is capped as soon as hole is grouted.

Chemical Additive Cuts Grouting Costs

A FAST, controlled-setting concrete additive has been used by Hanna Coal Co. to slash grouting costs by $10,000 on two shafts at the new Ireland Mine in West Virginia. About 18¾ cubic yd of grout, pumped from surface, were used on the No. 2 shaft to stop a maximum water inflow of 250 to 300 gpm, 100 ft below the shaft collar. An estimated 3,300 bags of cement would have been needed without the additive. No. 3 Ireland shaft was pregrouted before sinking with greatly reduced costs.

Excavation of surface material at the No. 2 shaft immediately ran into trouble since up to 20 ft of fill had been spread on the mine site to raise the mine elevation above maximum flood stage of the Ohio River. The loose fill was no barrier to surface water. Hanna decided to grout the area before further sinking.

Grout holes were drilled 8 ft from the shaft perimeter on 8-ft centers. A 10-ft length of scrap pipe was grouted solidly into each of the 12 holes. A 50-50 mixture of sand and cement was used, into which a 50% solution of Sika No. 2 chemical additive was mixed to speed setting. Initial set took place in 15 minutes, dilution of the additive slowing down the chemical reaction. (The material will set "hard" in 15 sec when used full strength with cement.) About 1¾ cu yd of grout were used in setting the piping.

Using the grouting pipes as a centering guide, 6-in. holes were drilled to 40 ft. A collar with a 3-in. nipple was welded to the pipe at ground level for attaching an air hose later on.

The purpose of grouting the pipes in place was to prevent air pressure from blowing the grouting material back up along the space between the pipe and the loose material surrounding it. The pipe in turn was used to assure that all the grout went down, rather than sideways, in the loose fill. The shaft area was then ready for grouting.

A mixture of grout containing No. 4 additive was used. The additive sets more slowly than No. 2 and was recommended by Sika's Pittsburgh district manager, R. E. Parlette. A 45-minute setting time was established, based on a 50° rock temperature and the distance which the grout had to travel. An average of one drum (55 gal) of No. 4 was used for every 4-cu yd batch made in a concrete truck mixer. The mix was usually equal parts cement and sand, but in many instances two parts cement to one part sand was used. One-half gal of No. 4 was used for each bag of cement. Altogether, a little more than 7 cubic yd of grout sealed off the water in the upper 40 ft.

Grout was funneled into the pipe nipple, filling the casing and flowing into the 6-in. hole. When the hole had been filled to overflow, a 1-in. air hose was attached to a threaded reducer which was in turn attached to the pipe. By using 75 to 90 psi air provided by a mine compressor, the grout was forced into rock fissures. The sequence was repeated three or four times on some holes and fewer on others. When the ground heaved around the hole it indicated that the grout had set.

Although the surface grouting sealed off water in the upper section of the shaft, heavy inflow was encountered between 50 and 100 ft. To keep the water from flowing into the deeper parts of the shaft during the construction period, a 3-ft wide water-ring level had been built around the shaft. The ring had a belled-out section surrounded by a lip at the edge of the shaft lining. Water collected along the concrete bottom of the water ring was pumped to the surface through a 12-in. borehole alongside the shaft.

Most of the inflow was sealed off in January 1958 by grouting down to the 100-ft level. The job was completed faster than the surface grouting to 40 ft because compressed air was not needed. The 100-ft column of grout in the 6-in. hole created enough pressure to assure penetration into crevices. It took 10 cu yd of grout, containing additive No. 4, to seal off most of the inflow of 250 to 300 gpm at the No. 2 shaft.

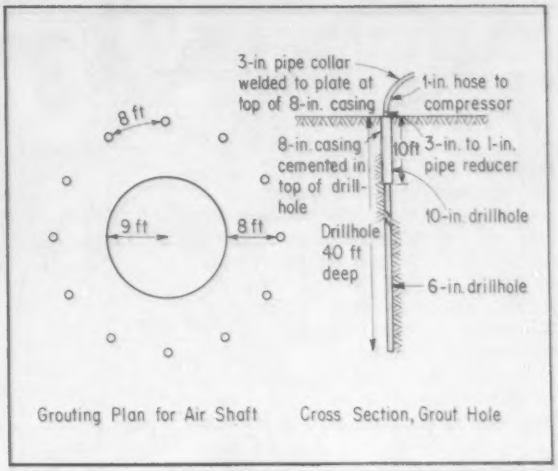
Advantages of the Sika additives were savings in volume of grout used, lower grouting costs and controlled setting, which together amounted to an estimated $10,000 saved on the job. Grouting under similar conditions has required as much as 3,300 bags of cement.

The Ireland Shaft

As a result of the heavy water inflow in the first two shafts, with consequent increase in sinking costs, the company was prompted to try presinking grouting for the third Ireland shaft.

Test boring on the third shaft showed water inflow so great that holes filled to the surface and could

AIR PRESSURE on previously filled hole (left) forces grout in crevices in the ground, while men funnel grout into new hole.


3-in. pipe collar welded to plate at top of 8-in. casing
1-in. hose to compressor
8 ft
8-in. casing cemented in top of drill-hole
10 ft
3-in. to 1-in. pipe reducer
10-in. drillhole
9 ft
8 ft
Drillhole 40 ft deep
6-in. drillhole
Grouting Plan for Air Shaft
Cross Section, Grout Hole

GROUT HOLES were drilled 8 ft from the shaft on 8-ft centers. Scrap pipe was grouted to act as a guide for 6-in. drillhole.

not be bailed out. The rate was estimated to be 200 to 300 gpm. The inflow convinced the company that grouting the area before excavation would be necessary to keep sinking problems and cost to a minimum.

Consequently, 12 holes for grouting were put down around a circle 10 ft out from the shaft perimeter and spaced 10 ft apart. The holes were sunk by first drilling a 10-in. hole to bed rock and then cementing a piece of scrap 8-in. casing in it. A 6-in. hole then was drilled to a depth of 20 to 40 ft, depending on the volume of water encountered. When the 6-in. hole was completed, a cap with a 3-in. pipe nipple in it was welded to the top as in the previous surface grouting system.

Grouting proceeded by filling alternate holes one at a time with grout made up of 1:1 mixture of sand and cement in which No. 4 quick setting additive was mixed. The line from an air compressor was attached to the pipe nipple and air pressure at 70 to 90 psi forced the grout into rock openings. The 8-in. casing served as a grout reservoir and was refilled if necessary.

As soon as a hole was completed, a cap was screwed onto the 3-in. pipe nipple to prevent grout being pushed out of the pipe while another pipe was being filled. It was necessary to fill only 10 of the 12 holes.

To get quick setting and to control the travel of the grout, No. 4 additive was mixed with sand-cement grouting. Hanna was particularly anxious to prevent the grout from flowing into the shaft area. To detect the distance which the grouting traveled, red concrete coloring material was added to the grout in the first several holes. The red color showed up in test holes around the shaft perimeter and was found bubbling up in a nearby stream. Even though the red color was detected in water in the test holes, the grouting could be controlled so as not to overflow into the shaft area.

As excavation took place, the company found that pregrouting had practically sealed off all the water.

Moab Turns to Alkaline Leach R-I-P

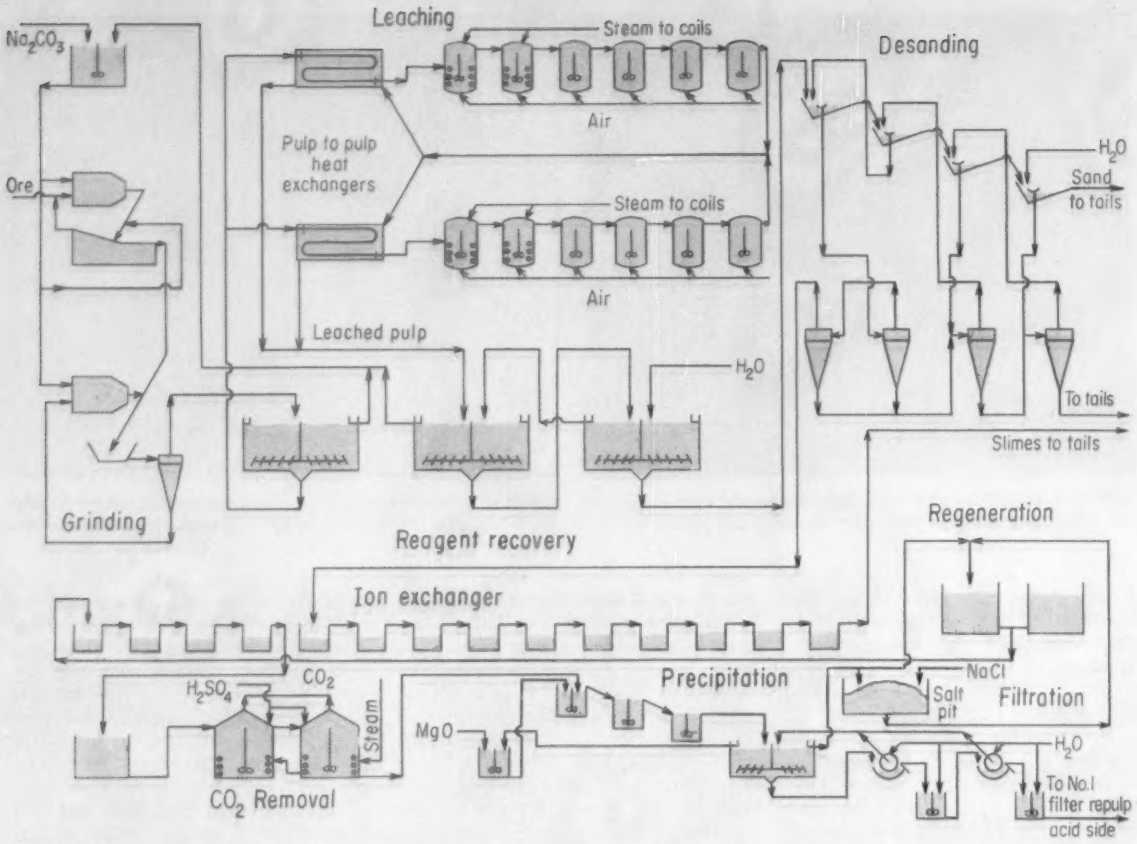
Ureco has contracted with Western Knapp Engineering to convert one of the acid leach circuits at Moab to alkaline in order to handle the high lime ores being developed in the Big Indian District. Alkaline leach R-I-P differs somewhat from acid R-I-P. Alkaline is cheaper—Moab will use about one ton of soda ash an hour with much of it regenerated and recycled. Alkaline leach requires pressure digestion in autoclaves; acid does not. The alkaline leach R-I-P Process was pioneered at Grand Junction by National Lead Co. and is in use at only one other place, National Lead's 300-tpd Monticello mill (owned by the Government and scheduled to close January 1, 1960). Moab expects to send plus 10% lime ores to the alkaline circuit which will be able to handle ores as high as 20 to 25% lime on a 90 to 95% recovery, according to Roy S. Hollis, general manager.

T. F. IZZO

Mr. Izzo is chief metallurgist, Uranium Reduction Co., Moab, Utah. He was co-author of a complete coverage of the Moab mill in January 1957 E&MJ.

AT SOME TIME in November 1959, Uranium Reduction Co. expects to convert 880 tpd of its present capacity to the alkaline leach resin-in-pulp process. The conversion of a major part of the tonnage treated at Moab from the acid resin-in-pulp process to the alkaline process was dictated by the increasing lime content of ores from the Big Indian District.

Economic analysis of the capital and operating costs of the alkaline-filtration and the alkaline resin-in-pulp processes show that ores containing high percentages of bentonitic slimes as are found in the Big Indian District can be treated at lower cost by alkaline resin-in-pulp process. As shown in the accompanying flowsheet, the ore is ground in mill solution containing 50 g Na_2CO_3/1 and 15 g $NaHCO_3$/1. Primary grinding is accomplished in a 7x7-ft ball mill in closed circuit with a 78-in. spiral classifier. (*Continued next page*)



ECONOMIC evaluation of the capital and operating costs of the alkaline-filtration and alkaline R-I-P processes show that ores containing high percentages of bentonitic slimes, as are found in the Big Indian District, respond better to alkaline.

The regrind circuit features the use of 10-in. cyclones to achieve a grind about 0.5% on 65 mesh, with the cyclone underflows returning to 6x9-ft regrind mill. The cyclone overflows at 30% solids are thickened to 50% solids in an 85-ft thickener. The thickener overflow returns to the mill solution tank for use in the grinding circuits.

The thickener underflow passes through the outer pipe of a concentric pipe pulp-to-pulp exchanger where the temperature is raised by hot pulp from the leaching circuit. Leaching takes place in two circuits of six 12x12-ft autoclaves where final temperature adjustments are made by steam coils in the first two vessels in each circuit. Leaching conditions are 8 hours at 250 deg F and 50 psig, with 1,000 cu ft of air per ton of ore introduced under the impellers.

The leached pulp flows through the inner pipe of the concentric pipe pulp-to-pulp heat exchanger to the first of two 85-ft reagent recovery thickeners operated in series with a countercurrent flow of water. At 50% solids underflow densities and one ton of water introduced per ton of ore, two-thirds of the leaching reagents will be recovered for recycle to the mill solution tank.

Sand-Slime Separation

The underflow from the second reagent recovery thickener is pumped to the sand-slime separation circuit consisting of parallel classifier and cyclone washing where a washed sand is discarded to tails and a slime product or resin-in-pulp feed containing solids, essentially all minus 325 mesh, at about 6% solids is sent to the resin-in-pulp circuit.

The alkaline resin-in-pulp circuit is operated mechanically in the same manner as the present acid resin-in-pulp circuits with ten banks on loading and four banks on elution. The eluant is a two molar solution of common salt. Sulphuric acid is added to the uranium-bearing eluting solution from the resin-in-pulp to pH 3.5 and the solution is heated to destroy the uranyl carbonate complex ions, the carbonate and bicarbonate in solution.

The uranium in the acidified solution from the CO_2-removal step is precipitated by the addition of a slurry of magnesia to the first of three precipitation tanks operated in series under continuous flow. The magnesia addition rate is controlled to discharge a precipitated uranium slurry at pH 7 from the last precipitation tank.

The slurry is thickened in a 20-ft thickener. A portion of the thickener overflow is pumped to a brine pit and a rich brine is drawn from the pit and rejoins the rest of the thickener overflow to provide regeneration of the eluting solution to be used in the resin-in-pulp circuit. The thickener underflow is pumped to two 4x4-ft vacuum drum filters in series with washing and repulping of the yellow cake with water at each stage.

The repulped cake from the second drum filter is pumped to the No. 1 yellow cake filter repulp in the present acid circuit where it is comingled with yellow cake from the first stage of product filtration from the acid R-I-P circuit. The mixed products are filtered on another 4x4-ft Peterson stainless steel drum filter and are dried in a Skinner 6-ft, 6-hearth multiple hearth roaster.

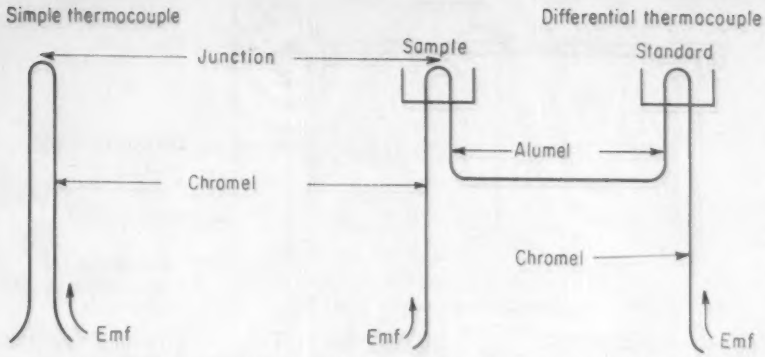


Fig. 1. Standard thermocouples measure direct temperatures while differential thermocouples measure temperature difference between reacting sample and alumina.

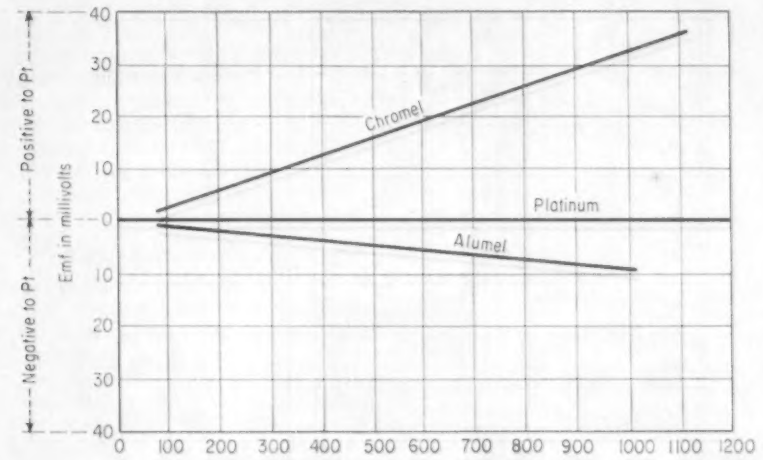


Fig. 2. Chromel and Alumel metals are plotted against base line of platinum which shows the straight line relation in emf generated when thermocouples are heated.

Hard-to-Analyze Minerals Yield to Thermal Analysis

DAVID S. SMITH
Assistant Editor

ANALYTICAL EQUIPMENT for rapid determination of clays; gangue, alteration products, and other difficult-to analyze minerals, some uranium ores, and oil shales, can be built from run-of-the-mine materials and a few local purchases. The method—differential thermal analysis (DTA)—measures temperatures of exothermic and endothermic reactions, gives a quantitative analysis, and indicates transformation points in minerals and metals. Much of this information cannot be obtained by chemical or X-ray diffraction.

DTA determines a range of reactions from loss of absorbed water and water of crystallization, release of the OH^- radical from the crystal lattice, devolatilization of coals and oil shales, transitions of the crystal lattice such as α to β quartz, loss of CO_2 from carbonates, to oxidation of sulphides and uraniferous shales.

The basis of DTA is simple and differential thermocouples. Simple thermocouples are two metal wires of different composition welded butt to butt (Fig. 1). The two free ends are connected through leads to a millivoltmeter or other suitable recorder. When the junction between the two wires is at a higher temperature than the ends, a current will flow.

Thermocouples are easy to make. Twist two dissimilar wires around each other two or three times. Snip off any excess and clip one free end onto one strand of a 110v ac circuit then quickly dip the twisted ends several times into a metal bowl of mercury connected to the other end of the circuit. This will burn back excess wire until butt-welded.

The metal bead formed between the wires should be as small as possible. Proper choice of wires will give a thermocouple whose electromotive force is directly proportional to the temperature difference between the heated junction and the ends. Chromel-Alumel thermocouples give a straight line relation, reproducibility, constant calibration, and reasonably large emf per degree of temperature difference at low cost (Fig. 2). Chromel-Alumel thermocouples measure furnace and sample holder temperature.

Chromel is 90% Ni and 10% Cr while Alumel is 94% Ni, 2% Al, 3% Mn and 1% Si. These alloys are common materials for thermocouples and should not be difficult to buy. Fine (22-gage) thermocouple wires are recommended.

The second type of thermocouple used in DTA is a differential thermocouple. It is much like simple thermocouples but is designed to measure temperature differences between a sample and a standard inert material.

Differential thermocouples have two junctions butt-welded in the series Chromel - Alumel - Chromel or Alumel - Chromel - Alumel (Fig. 1). Emf's of two opposed junctions will cancel out unless the tip of one thermocouple is receiving more heat than the other. By placing one junction in the sample and one in an inert standard such as powdered alumina (Al_2O_3), emf differences between the sample and standard are measured, detecting endothermic or exothermic reactions.

When an exothermic reaction occurs, the sample-thermocouple receives more heat than the standard thermocouple, causing upward deflection of the thermal curve. Endothermic reactions lower the curve. At transition points, the sample heats up at a different rate than the standard and small transformations of the crystal lattice are detected.

Six Sample Unit

The following DTA design is the product of the mineralogy department of Columbia University. DTA was originated at Columbia by Professors P. F. Kerr and J. L. Kulp and the work was extended by Professors Kerr and R. J. Holmes.

A sample holder or sample head is machined from heat resistant chrome-nickel steel alloy and designed to make six separate analyses at one time (Fig. 3). The head is cylindrical,

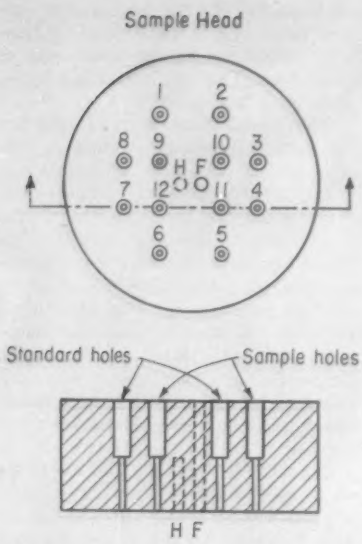


Fig. 3. Sample head is built for furnace temperature (F) and head temperature (H) thermocouples. Even holes are filled with sample, odd holes with alumina.

3-in. dia and 2 in. thick. Twelve holes of ½-in. dia are spaced over the flat surface and drilled to 1 in. depth. Countersunk in the ½-in. holes are twelve ⅛-in. holes drilled completely through the head for differential thermocouples. A hole of ⅛-in. dia is drilled through the center of the head for a furnace-temperature thermocouple. On the other side of the head, about ¼ in. off center, a ⅛-in. dia hole is drilled 1 in. into the sample block for the head-temperature thermocouple. The head is then mounted on a hollow cylinder of alumina (sintered Al_2O_3) about 10 in. high and centered in the furnace.

After thermocouples have been insulated with alumina spaghetti, they are cemented into sample holes with a mixture of finely powdered alumina and sodium silicate (water glass). Welded junctions of sample thermocouples must be centered vertically in the holes and an equal distance from the sides or they will heat unevenly.

Samples are prepared by dry grinding to minus 50 mesh. Little other preparation is necessary so long as the sample is dry.

Sample-holes are filled with the powdered sample and the standard-holes with alumina of minus 60 to plus 200 mesh. Each standard-alumina-thermocouple is paired off with a sample-thermocouple. Packing sample or standard in the holes has little effect. A single insulated thermocouple is then cemented in the block for the head temperature and another through the block for furnace temperature.

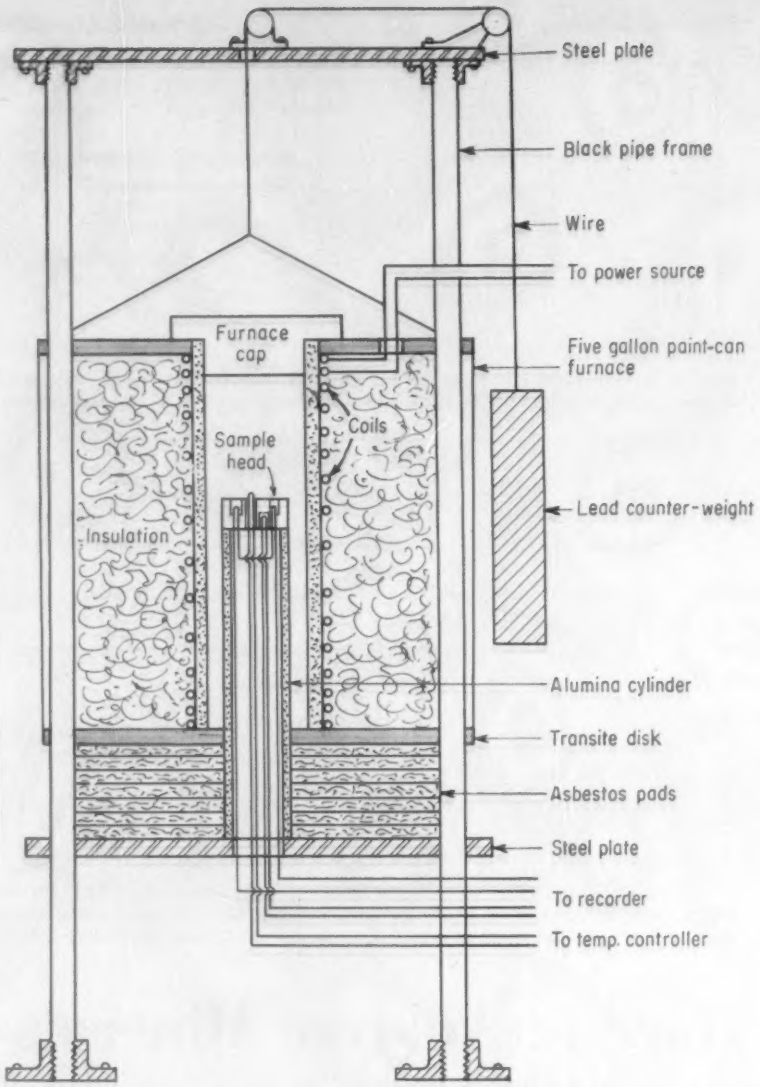


Fig. 4. Paint-can furnace may be built in the shop. It is designed to be raised or lowered when the sample head is serviced. Lead counter-weight balances system.

An excellent furnace (Fig. 4) can be built from a five gallon paint-can with both ends replaced by tough insulating board. A central alumina muffle is placed in the furnace and wrapped with helical Nicrome wire. Heavy gage Nicrome provides longer furnace life. Empty spaces between the central core and outer furnace walls are packed with calcined diatomite or bubble alumina for insulation.

The furnace unit is mounted in a metal frame of black pipe so the unit can be raised when the sample head is serviced. After making a run, the furnace is raised and holes blown out with compressed air. If the sample cools too long before blowing it may cake in the holes.

The Columbia system used a Leeds & Northrup "Micromax" program controller connected to the furnace-temperature thermocouple for heating-rate control. Furnace temperature can be raised or lowered from 0 deg to 50 deg C per minute and will automatically hold the sample at any desired temperature. In tests, heating rates of 12 deg C per minute were found to give the most clearly defined peaks. Furnace temperatures seldom were run above 1050 deg C, since high temperatures reduce thermocouple and furnace life.

Recording instruments range from a millivoltmeter to multivariable recorders, depending on budget and need for permanent records. In Columbia's system, dc current from thermocouples is led to a preamplifier which boosts the signal to recordable

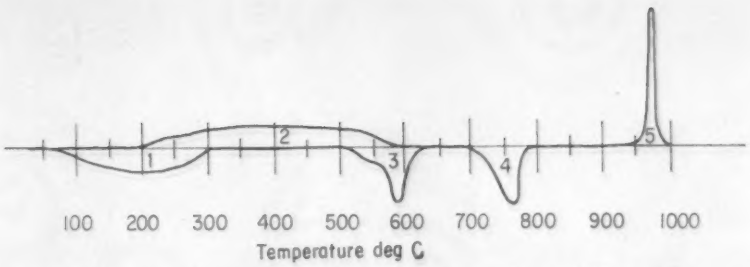


Fig. 5. Composite differential thermal curve illustrates the possible reactions that are measured with DTA. Peak locations may vary depending on mineral species.

levels and then is channeled to a Leeds & Northrup "Speedomax" six variable, high speed, high sensitivity electronic recorder with a maximum range of 3 millivolts. Chart speed is synchronized with the program controller. Permanent records are valuable for comparison of known samples with unknowns.

Standard procedures are followed in describing thermal curves.

(1) Peaks are measured up or down from a straight line with endothermic down and exothermic up.

(2) Furnace temperature is measured along the horizontal axis.

(3) Peak height is the temperature difference between the sample and standard.

(4) Area under the peak is measured between the two points where the curve begins and ends. Area is proportional to the amount of thermally active mineral involved.

Quantitative analysis is carried out by measuring the area under a selected curve and dividing by the area under the equivalent curve for a pure sample run with the same equipment. This gives the ratio of the mineral in a mixed sample.

Thermal Curves

There are at least five deflections that occur on a thermal curve (Fig. 5 — ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY):

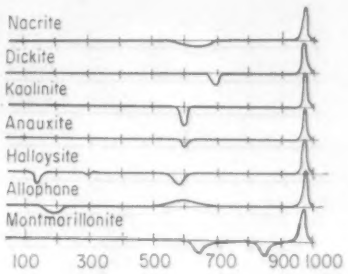
(1) Broad, low endothermic curves between 100 and 300 deg C indicate loss of absorbed water.

(2) Broad asymmetrical exothermic curves show oxidation of organic matter in clays between 200 and 600 deg C while a sharp exothermic reaction between 400 and 500 deg C is oxidation of pyrite or marcasite.

(3) Loss of lattice water between 450 and 700 deg C gives symmetrical large-amplitude curves with a broad base.

(4) Carbonates show large asymmetrical deflections between 450 and 900 deg C and

(5) Narrow, high-amplitude exothermic peaks of the clay minerals corresponding to transformation of amorphous alumina to α-alumina



which will occur near 1000 deg C.

Above are typical clay curves (ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY).

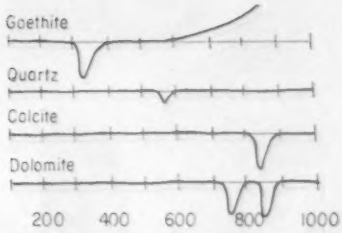
In the graph, clay minerals show their characteristic sharp peak at 980 deg C where amorphous alumina adjusts to the α-alumina form. From the curves it is possible to distinguish definitely between the three kaolin minerals—nacrite, dickite, and kaolinite. Anauxite has a curve similar to kaolinite except for a slightly smaller area under the endothermic peak. This peak is due to decomposition of lattice into amorphous silica and alumina. Halloysite can be distinguished readily from other kaolin minerals because of two low-temperature peaks at 150 to 325 deg C. Allophane is so fine-grained that it is sometimes considered amorphous. As a result, both of the peaks at 180 deg C and 510 deg C have long bases and are not as clearly defined.

Montmorillonite minerals are thought to have a symmetrical sheet structure similar to pyrophyllite and are characterized by a double endothermic peak.

Talc gives a clear endothermic peak at 990 deg C. The high temperature of this main endothermic peak shows the great strength of the OH^- bonds in the talc crystal lattice. Gibbsite has large heat absorption at 350 deg C, which is to be expected from its high water content (more than twice the kaolin minerals). Diaspore gives a single definite peak at about 550 deg C.

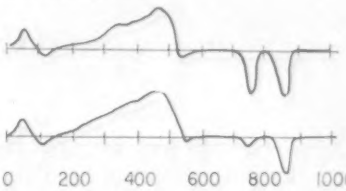
Gangue Minerals

Common gangue minerals have the following curves:



Quartz has a phase inversion from α to β quartz at 575 deg C, calcite exhibits its usual endothermic peak with the loss of CO_2 between 800 and 900 deg C, while dolomite ($CaMg(CO_3)_2$) shows two peaks, one for the loss of CO_2 from the Mg ion and one from the Ca ion.

As an example of a mineral mixture, the following is an analysis of two limey shales, high in sulphides and soluble salts.



Shale A (top) is dolomitic variety. Shale B (bottom) has more limestone.

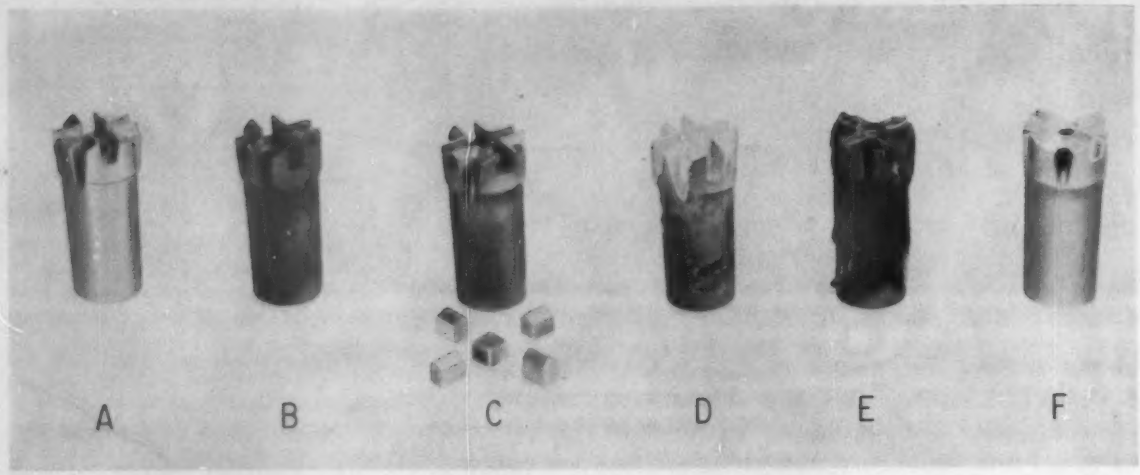
The curves indicate that shale A had most of its carbonates in the form of dolomite. In shale B, limestone was more abundant. This is shown by the double endothermic reactions that occurred between 700 and 900 deg C in A and the single large peak between 800 and 900 deg C in B.

The exothermic reaction peak between 400 and 500 deg C is due to combustion of carbonaceous material and to the oxidation of marcasite. Between 100 deg C and 150 deg C there is an exo-endothermic reaction that cannot be attributed wholly to dehydration of the shale. Dehydration of mechanically held water never occurs exothermically in clays. Such a reaction is indicative of tridymite quartz. Neither curve shows the reaction of large amounts of clay mineral, but this is typical of illite shales that contain less than 50% illite.

Many variations exist on the general DTA scheme. Oxides, sulphides, and arsenides react with thermocouples and often ruin them with one run. Organic impurities mask other reactions when they are oxidized.

The sulphide problem is combated by using ceramic cups for samples with a tiny central nipple over the thermocouple.

Curves for uraniferous shales are normally masked by oxidation. The problem is solved by running them under an inert gas such as helium in an air-tight bomb.



STAGES IN THE MANUFACTURE OF A DETACHABLE DRILL BIT ARE:

A. Machined bit blank.
B. Bit blank after it has undergone salt bath heat treatment.
C. Bit blank after grit blasting, with pilot and carbide inserts in foreground.
D. Bit with inserts assembled and fluxed, prior to oxy-acetylene brazing process.
E. Bit after brazing, with adherent flux.
F. Finished bit.

New Oxy-Acetylene Brazing Machine Speeds Tungsten-Carbide Bit Assembly

A NEW MACHINE for rapid, low cost oxy-acetylene brazing of tungsten-carbide drill bits is now in operation. Custom designed and built by Linde Co., Div. of Union Carbide Corp., the machine recently commenced full scale operations at the Noranda, Que. plant of Har-Pur Products Co.

First of its kind in the world, the installation replaces electric induction heating and furnace brazing methods. With the new process, bits are brazed between two diametrically opposed oxy-acetylene heating heads which are adjustable to permit handling of bits varying from 1⅜ in. to 3 in. in dia.

There are several important advantages with the oxy-acetylene process. They inclue substantially lower costs—both initial and operating, faster brazing (50 sec vs 2 min for induction heating), and greater flexibility. Exhaustive tests have shown the bits to be of excellent quality, with less tendency for the carbide inserts to "pop out" or fracture during drilling operations.

Linde's oxy-acetylene brazing process is especially effective in operations where the use of tungsten-carbide detachable insert type bits exceeds 50 per day. Rates three to four times as great would normally be required to justify a more expensive induction heating installation, according to Linde.

FIG. 1. HEAT TREATING OF BIT BLANK: First, the ABT-28 steel bit blanks are heat treated for hardness control. The blanks are immersed, 40 at a time, in a salt bath furnace until uniform temperature is reached. Then they are drawn in an electric oven at carefully controlled temperatures.

FIG. 2. WASHING OPERATION: Following salt bath treatment, blanks are immersed in hot water for 10 to 15 minutes to remove salt deposits. The washing tank shown above is electrically heated to a uniform temperature and the bit blanks washed in the wire basket.

FIG. 3. BLAST-CLEANING. After washing, the blanks are blast-cleaned in this pneumatic grit blast cabinet to remove scale and discoloration. Rubber gloves and safety glass viewer protect worker from injury.

FIG. 4. CARBIDE INSERT ASSEMBLY. Blanks are now ready to receive tungsten-carbide inserts. Rows of clean blanks with pilot insert in position are to the right of the operator. Carbide bits immersed in carbon tetrachloride are to the operator's left. Open boxes in foreground contain silver solder shims. The sequence of assembly is as follows: (1) fluxing the bit inserts, (2) installation of silver shims in slot bottoms, (3) inserting carbide bits and tapping into position and (4) a second and final fluxing before brazing.

FIG. 5. OXY-ACETYLENE BRAZING: The bit is brazed between two diametrically opposed heating heads which are adjustable. Time cycle is 50 seconds from room to brazing temperature. Heating cycle is controlled by an electrical timer.

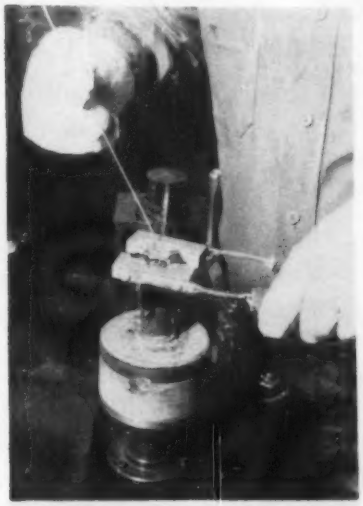


FIG. 6. SEATING THE INSERTS. After brazing, it is important that carbide inserts be properly seated while the silver solder is still in a liquid state. Proper seating eliminates gas pockets underneath the inserts which, if left, could result in subsequent fracture of the bits. A special insulated gripping tool forces the inserts into place.

FIG. 7. MARTEMPERING: After seating, the brazed bits are immediately placed in a post-heating furnace. The martempering or stress relieving operation minimizes locked up stresses and assures proper bit hardness.

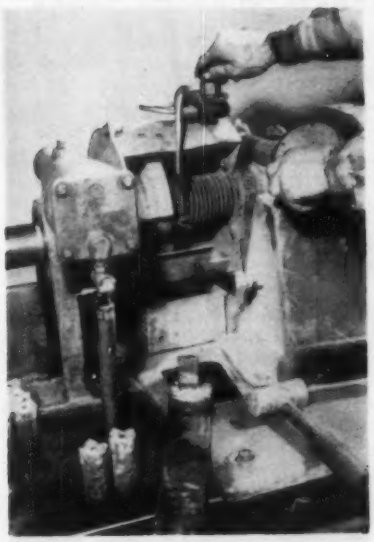


FIG. 8. GAGE GRINDING: A second hot water wash similar to that illustrated in (2) then takes place. An air-driven grinder automatically grinds inserts to a specified gage and shape (assuring even wear and shock on the bits during drilling operations). A second grit blast cleaning, a hand-grind chamfering operation on the inserts and finally punching out the pilot insert in the center of the bit completes the process except for painting and packaging.

FIG. 9. FINAL INSPECTION: Before painting, a hardness check is carried out on a percentage of the finished bits as a standard quality control measure.

India Expands Ferromanganese Industry

L. NAHAI

AN INCREASING SUPPLY of ferromanganese in India, made available by expansion of installed capacity, will seek markets in the U.S. Modest shipments received in 1958 and 1959 may substantially increase under a barter agreement signed in March 1959 by the U.S. Government and the government of India under Title III of the Agricultural Trade Development and Assistance Act, as amended.

The agreement provides a general intergovernmental framework for U.S. export of approximately 457,000 long tons of food grain "in exchange for such quantities of manganese ore, ferromanganese, and such other materials as may be agreed upon. . . ." In response to a question in India's Lok Sabha (lower house of parliament) on April 22, 1959, the Minister of Commerce and Industry stated that 75,000

Mr. Nahai is near east specialist, Div. of Foreign Activities, USBM, Dept. of the Interior. Published by permission of the Director, USBM.

Ferromanganese Plants in India

Plant location	Ownership	Capacity (long tons)	Start of production	No. of furnaces	Power source	Remarks
Joda, Orissa State	Tata Iron & Steel Co.	30,000—to be expanded ultimately to 100,000 tons	1958	Two, 9,000 kva each, made by Electrokemisk A/S, Norway	Hirakud hydroelectric powerplant, 100 miles away	The plant will be connected by rail to Banspani, the latter connected to Dangoaposi Ry. station on the Raj Kharsawan—Gua line.
Rayagada, Orissa State	Jeypore Sugar Co. Ltd.	20,000	1958	Two, 3,750 and 7,500 kva.	Machkund hydroelectric powerplant	114 miles by rail from port Vizagapatam.
Garivadi, Andhra Pradesh State	Ferro Alloys Corp. Ltd., Tumsar	40,000	1958	Three, 7,000 kva each	Machkund hydroelectric powerplant	Garivadi is a village 56 miles by road northeast of port Vizagapatam. A railway spur connects the plant to Garivadi Ry. station.
Bhadravati, Mysore State	Mysore Iron & Steel Works	1,800	1956	One	Jog hydroelectric powerplant	
Dandeli, Mysore State	Electro-Metallurigical Works (Pvt.) Ltd., Bombay	6,000[1]	1958	One, 3,750 kva		
Tumsar, Bombay State (67 miles east of Nagpur)	Cambata Ferromanganese (Pvt.) Ltd., Bombay	30,000	1960	Two, 9,000 kva each	Steam generated power from Khaperkheda station 10 miles east of Nagpur with 30,000-kw capacity	
Kamptee, Bombay State (15 miles east of Nagpur)	Khandelwal Ferro Alloys Ltd., Bombay	30,000	1960	Two, 9,000 kva each	Steam generated power from Khaperkheda station 10 miles east of Nagpur with 30,000-kw capacity	

[1] To be expanded to 12,000.

Courtesy of Tata Iron & Steel Co.

tons of ferromanganese would be delivered to the U.S. by Nov. 30, 1959, unless the period were extended by mutual agreement. Although no shipments have been made yet under the barter agreement, attention has been drawn to the ferromanganese industry in India.

Reserving India's mineral resources for her future use and processing minerals before export to command higher foreign exchange earnings have been fundamental tenets of India's mineral policy. Although execution of the policy has been modified and tempered by economic exigencies and existing trade patterns, the objective has remained the same. It is, therefore, not surprising that the production of ferromanganese for domestic use and export has been a matter of interest to India's government and private industry.

Pursuing the above policy and to meet requirements of the expanded steel industry, India's Planning Commission set a 1960-61 target of 172,000 long tons[1] of ferromanganese capacity per year and of 160,000 tons of production, of which 100,000 tons would be available for export. By mid-1959 significant progress was made in achieving the objectives. Five plants with an aggregate capacity of 100,000 tons were completed and were in various stages of production; two plants with a capacity of 60,000 tons were under construction and are scheduled to come into production by 1960.

Raw material requirements for this production are estimated at 320,000 tons of high grade manganese ore, 92,000 tons of coke, 80,000 tons of limestone, and 500- to 650-million kw of electrical energy,[2] all of which are readily available in India.

However, Indian manganese and coke are not ideally suited for making standard grade ferromanganese. The manganese-iron ratio in much of the ore mined is less than the desired optimum, say eight to one. Indian coke is also high in ash and phosphorus. The adoption of electric smelting has alleviated the phosphorus problem because coke is used only for reduction of the ore and proportionately less of it is needed per ton of ferromanganese. Decreasing consumption of coke also reduces the large slag volume created by the ash content of the coke. The industry in India expects that beneficiation will make available the large tonnage of low-iron manganese ore needed for expanded ferromanganese production. One company, Ferro Alloys Corp., is setting up an ore beneficiating plant to improve quality of ore available from Garivadi mines.

Production of ferromanganese dates back to 1915 and, until the last few years, Tata Iron & Steel Co. (see E&MJ, July, p 152) was about the sole producer, although Indian Iron & Steel Co. also had produced some for its own consumption. The output for the last 10 years, shown in the tabulation, follows an erratic pattern:

Production of Ferromanganese in India, 1949-58

Year	Long tons	Year	Long tons
1949	17,000	1954	36,800
1950	15,600	1955	6,700
1951	22,000	1956	24,000
1952	35,000	1957	4,600
1953	2,800	1958	44,500

(Continued on p 210)

1. THE NEW INDIA—PROGRESS THROUGH DEMOCRACY. The Macmillan Co., p 279.

2. JOURNAL OF INDUSTRY AND TRADE, October 1956, p 1481.

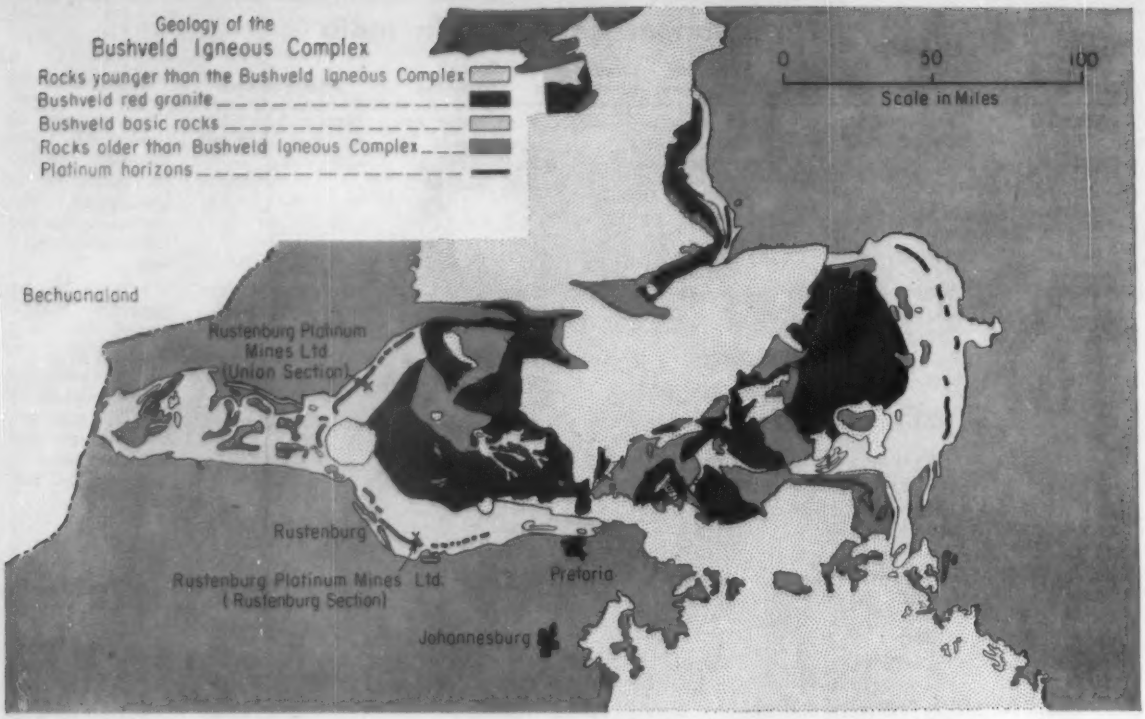


FIG. 1. The largest reserve of platinum ore in the world is mined by Rustenburg Platinum Mines Ltd. in basic rocks of the Bushveld complex. The igneous series also contains a large reserve of titano-magnetite, chrome ore and vanadium.

Mining Africa's Huge Platinum Reef

C. A. COUSINS

THE WORLD'S LARGEST reserve of platinum occurs in the Merensky Reef, part of the Bushveld igneous complex, mined by Rustenburg Platinum Mines Ltd. The Bushveld complex is an irregular oval area of some 15,000 sq miles occupying a roughly central position in the Transvaal (Fig. 1).

Mr. Cousins is manager of the industrial division of the Johannesburg Consolidated Investment Co. Ltd. The article is extracted from "Platinum Metals Review," (London), July 1959, pp. 94-99.

The complex rests upon a floor of sedimentary rocks of the Transvaal system. The floor is an immense oval basin, 300 miles long and 100 miles broad. Sediments forming the floor have been extensively altered by thermal metamorphism. The complex consists of a vast body of basic, magnesium-rich rocks, the silica content of which gradually increases upwards. Overlying the basic zone, whose predominant rock type is either norite or gabbro, lie sheets of the red Bushveld granite.

Geological and economic interest center around the mass of basic rocks. The rocks are exposed, as outcrops, in three areas covering over 5,000 sq miles. Two of the areas lie at the eastern and western ends of the Bushveld and form wide curved belts, trending parallel to the sedimentary rocks which they overlie, and dipping inwards towards the center of the Bushveld at similar angles. The western belt has a flat sheet-like extension reaching the western boundary of the Transvaal. The third area extends northward and cuts outside the sedimentary basin.

The eastern and western belts contain the more important economic

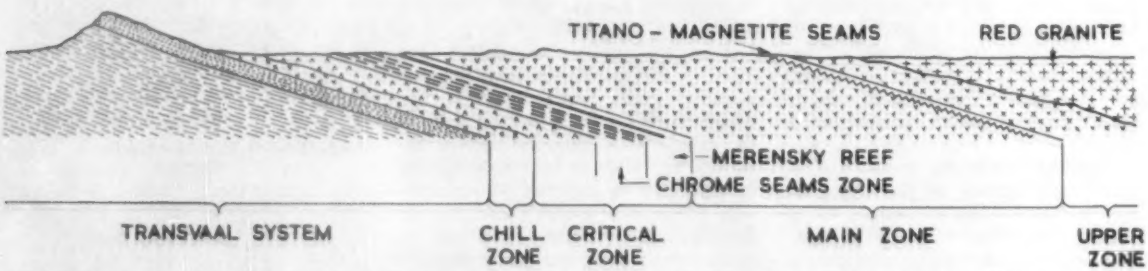
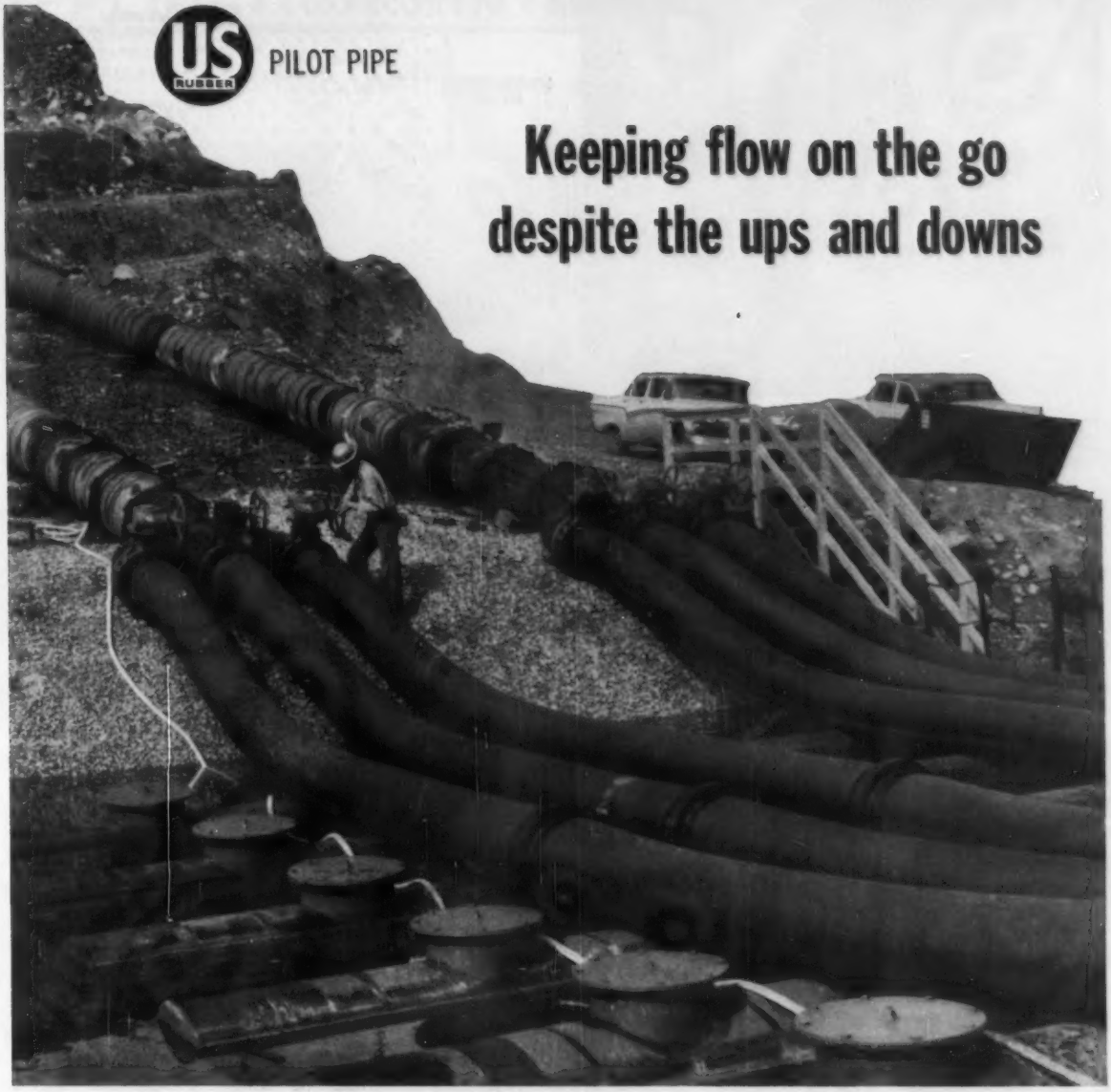


FIG. 2. Platinum is mined in the Merensky Reef section of the Bushveld igneous complex. Bands of chrome ore from 1 in. to 8 ft thick also extend with great regularity in strike and dip along the outcrop, which make for easy mining.

US RUBBER PILOT PIPE

Keeping flow on the go despite the ups and downs



A taconite mining company in Minnesota operates 365 days a year, has capacity to produce 7,500,000 tons of iron ore pellets a year.

To produce a ton of taconite pellets requires over 100 kwh of electric power and 25 tons of water. This plant, at its present production rate, pumps almost 65,000 gallons of water a minute. It is utilized so carefully that the make-up water requirement is held to less than 5,000 gallons a minute.

Two large diameter metal pipes lead from the barge pumping station to the concentrator. Three 16" U. S. Rubber Pilot® Pipe lines connect each pipe with the barge pumps. "U. S." Hose is used because due to rain or snow the barge may rise 7 feet or more, or sink as much as 10 feet, straining the hose and connectors.

U. S. Pilot Pipe is extremely flexible, yet very strong. Withstands up to 250 lbs. pressure, and extreme temperatures ranging to 45°F below zero. The plant cannot operate without water, hence "U. S." Hose is the *water lifeline*. Its dependability explains why U. S. Rubber is the world's largest manufacturer of industrial rubber products.

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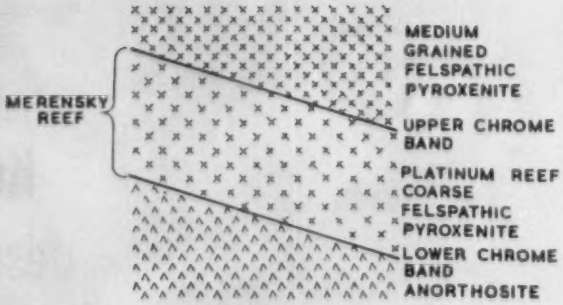

FIG. 4. Section across reef shown in Fig. 3. Platinum ore mined from the reef also contains iron, nickel and copper.

FIG. 3. Miners charge a blast hole at Rustenburg. The white anorthosite footwall can be seen level with miner's knee.

zones. The two curved inward dipping belts have been estimated to reach 15,000 to 18,000 ft in thickness. The belts are divided into four main zones, the chill zone, the critical zone, the main zone and the upper zone. An idealized geological section is shown in Fig. 2.

The chill zone was formed by the earliest part of the igneous magma which came into contact with the sediments of the floor and was cooled rapidly. Its thickness is estimated to lie between 500 to 1,000 ft.

The chill zone grades into the critical zone, estimated to be from 4,000 to 5,000 ft thick, in which the most valuable minerals are found. Within the zone is a remarkable sequence of layered rocks which, although obviously igneous in origin, show all the characteristics of an unusually regular sedimentary series.

Rocks consist of alternations of pyroxenites, anorthosites and norites. Layered within the rocks are regular seams of chrome ore, ranging in thickness from 1 in. to more than 8 ft, while near the top of the zone occurs the platinum-carrying Merensky Reef.

One feature of the critical zone is that individual bands can be traced around the entire outcrop of the complex. The chrome seams and the Merensky Reef seem to retain their individuality with only minor variations. Boreholes show them to continue unaltered in character to depths of 3,000 ft.

Above the critical zone, 8,000 to 10,000 ft of norite (or gabbro) is met. This is known as the main zone. Here the remarkable layering of the critical zone becomes inconspicuous or absent. At the top of the zone, layering again reappears with bands of titano-magnetite, from 1- to 6 ft thick, lying on white anorthosite.

The upper zone, less than 1,000 ft thick, forms the uppermost portion of the zone of basic rocks wherein rocks become richer in quartz and poorer in pyroxene. Above the upper zone, red granite, showing tin mineralization, outcrops over 5,000 sq miles in the interior of the complex.

The area between the two zones of basic rock outcrops is covered by sheets of the Bushveld granite and younger sedimentary rocks. In addition, outcrops of the Transvaal system rocks are also found in the interior.

The platinum-carrying Merensky Reef has been prospected over disances of 75 to 80 miles along both the eastern and western outcrop belts. Platinum values are persistent but in some areas values are consistently higher than in others.

Rustenburg Platinum Mines Ltd. mines the Merensky Reef at two sections of its property, the Rustenburg Section a few miles to the east of the town of Rustenburg and the Union Section some 60 miles to the north.

Platinum is not found in the pure state, but is a composite of platinum group metals, their relative proportions showing variations from one area to another. Platinum is the predominant metal, followed by palladium, with smaller amounts of ruthenium, rhodium, osmium and iridium, together with traces of gold. A proportion of the platinum is present as "native" metal, invariably alloyed with iron (ferro-platinum), while the remainder occurs as the arsenide and sulph-arsenide, sperrylite and cooperite. Ore invariably contains a few per cent of the sulphides of iron, nickel and copper. The nickel and copper are extracted as a by-product from the platinum concentrates.

Merensky Reef in its typical section, (Fig. 3 and 4) is a coarsely crystalline aggregate of pyroxene and feldspar, with sulphide mineralization. It underlies a finer grained bank of a similar rock and rests with a sharp contact on a band of white anorthosite. Thin seams of chrome ore, usually less than an inch thick, are found on both the top and bottom contacts. In some areas, however, one of the chrome seams may be absent. Ore within or adjacent to the chrome bands is generally richest in platinum. A feature of the reef, which makes for easy mining, is its regularity in dip and strike and the evenness of its values.

Dikes and faults are rare in the two mines controlled by Rustenburg. The only underground complication is the occurrence of "potholes." They are roughly elliptical areas in which the reef suddenly becomes displaced into the footwall and is often disturbed and broken. The reef can, however, be mined out in a considerable proportion of potholes. Their origin is still a mystery.

The reef has been proved by drilling down-dip on the Rustenburg and potential ore reserves are very considerable.

Chrome seams of the Bushveld, while of lower grade than the Rhodesian or Turkish ores, form the major proportion of total known chrome reserves of the world. Their continuity in thick seams over scores of miles of strike and their persistence in depth make for easy and cheap mining.

Titano-magnetite seams of the main zone are continuous over large areas and contain fractional percentages of vanadium. Extraction of vanadium and titanium will probably be attempted in the future.

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APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe

Flexpipe helps meet tough piping problem in air conditioning an existing building

THE PROBLEM: Air conditioning an existing office building usually calls for a bit of ingenuity in design. One large New York office building decided to air condition by making provision for packaged, water-cooled units to be installed on any floor as tenants required.

This called for four 10-inch risers, running the height of the building, to carry cooling water between the cooling tower and the branch pipes at each floor level. Because of structural conditions, the risers could not be run down through the basements and supported from below. The combined weight of pipes and the water was so great that they could not be anchored at any one point on the structure.

So the consulting engineers, Zimmermann Engineering, New York, floated the risers on spring hangers, distributing the weight evenly over all floors. This meant, however, that the risers were free to move. A riser full of water weighs several tons more than an empty one and settles about two inches.

Therefore connections between risers and branch pipes had to be flexible. They also had to have strength, because water pressure at the lower floors approaches 400 psi.

THE SOLUTION: Flexpipe connectors were the answer. They provided the flexibility and the strength required. Furthermore, they were available in the sizes needed —from 5" diameter at the lower floors to 2" at the top floors.

WHERE TO BUY: Flexpipe connectors come in convenient standard sizes and are sold by leading distributors. They can show you samples and answer questions about service applications. For the name and address of the one serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ont.

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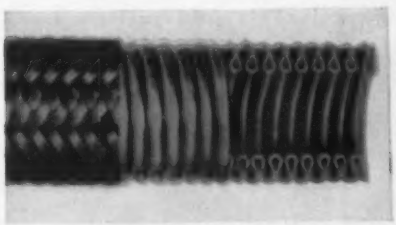
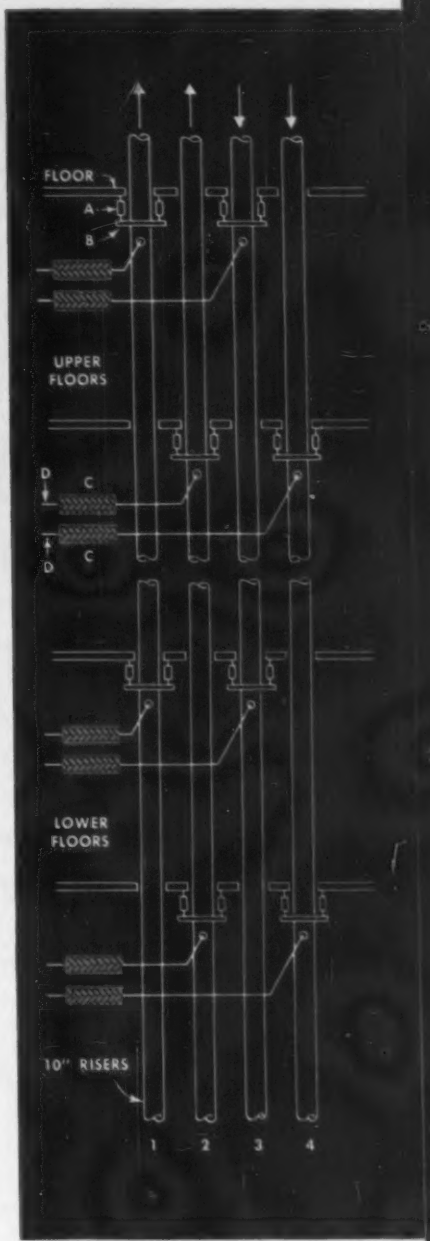


FLEXPIPE'S flexible core can be either tin bronze, hot dipped galvanized steel or stainless steel. End fittings (attached): flanges, threaded males and welding nipples.



SCHEMATIC DIAGRAM showing how cooling-water risers were installed. A: spring hangers. B: pipe clamps. C: Flexpipes. D: branch pipes at each floor. 1, 2, 3, and 4: risers, 10 inches in diameter. *Upper left:* Photo of Flexpipe installation at a lower floor.

Flexpipe® an ANACONDA® product

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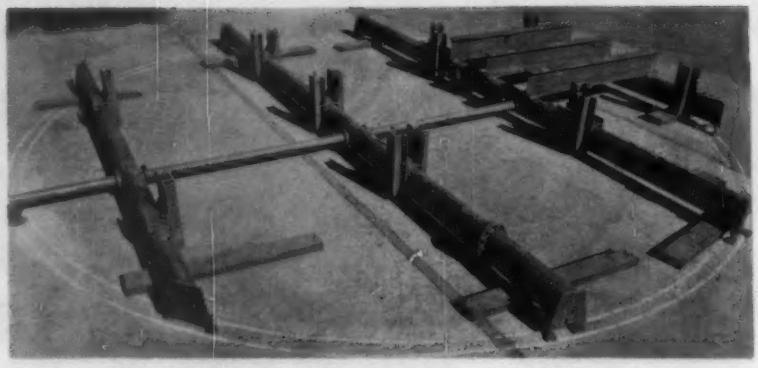
OPERATING IDEAS

Revised Bunton Cuts Down Air Resistance in Deep Shafts



A NEW TYPE BUNTON which greatly reduces air resistance has been designed by Hall, Longmore at Krugerdorp, South Africa. According to the Johannesburg office of McGraw-Hill World News, the oval steelwork was tested for strength by the Council for Scientific & Industrial Research.

In a conventionally dimensioned shaft, about 1.1-million cu ft of air are drawn down every minute. With the new equipment, and the lessening of resistance that it brings about, the capacity of the required machinery is cut down by about 25% per round. Although the new design adds a good deal to the unit cost of the bunton, the overall saving has been figured at about $50,-400 a shaft.

Steel used in the new equipment is much stronger and lighter than the conventional eye-shaped lengths. The buntons are put down the shaft at longer intervals. At Western Deep Levels mine, they're being put 15 ft apart—at Vaal Reefs, 20 ft.

Spacing in the buntons accomodate two 15-ton skips; two cages, each carrying 120 men and two others, each with a capacity of 30 men. Four short eye-sections at wide intervals down the shaft carry heavy water pipes with a capacity of 40-million gpd.

The report concluded by saying that the "possibilities of the new method of dealing with airflow resistance are increased with the deepening of the mineshafts. Since mines are getting deeper, potentialities are enormous."

How to Choose Correct Hauler to Minimize Rock Handling Costs

ROCK HANDLING COSTS will be kept to a minimum if a sensible choice of using either scrapers or trucks can be made at the start of operations.

In the July 1959 Co-Operator, (Le Tourneau-Westinghouse's magazine) Gene S. Hart, field engineer said the following:

Considering only the rock on the job, it may be less expensive to handle it with trucks and a shovel. The scrapers, push tractors and rippers in hard rock will require more maintenance and repair than in easy loading materials. However, when one scraper stops for repairs, the resulting production loss is in direct ratio to the number of units hauling. If a shovel breaks down, there is 100% production loss.

The load time for a scraper in hard material is less than 1.5 minutes. A truck of similar capacity loaded by a shovel needs approximately 3.5 minutes. Fixed time portion of a round trip or cycle includes loading, spotting or waiting, dumping, turning and accelerating. The fixed time portion for pusher-loaded scraper should not be more than 2.5 minutes in hard materials, while a truck with a shovel loading it will have a fixed time element of at least 5 minutes.

A scraper travelling at 12 mph average speed will have covered 2,640 ft of its haul during the fixed time difference between the two units. If the dump area is several thousand ft from the loading point, trucks can make up some of the difference by travelling faster. In easy loading material, a scraper-pusher fleet can double the production of a truck-shovel setup. The shovel limits the production portion of its fleet setup.

The operator who does not have other tough jobs for his truck-shovel fleet but has rock on his job that is movable by scrapers will show a better profit at job completion if he does all the work with his scraper-pusher tractor fleet. He can pay the extra maintenance and repair cost per cubic yd for the material that is moved.

The following table outlines a hypothetical job involving both hard material and easy loading dirt. Round trip haul distance is 6,000 ft. In hard material, the scraper fleet is composed of four rubber-tired self-propelled scrapers, a pusher tractor, a large tractor-mounted ripper and a motor grader. For the easy-loading dirt section, a fifth scraper is added because of shorter load time, and the tractor-ripper is eliminated.

The truck-shovel fleet is made up of three trucks, a shovel, a motor grader for haul roads, a tractor-dozer for the dump and an air compressor with a rock drill to prepare for blasting when needed.

Cycle Parts	Scraper-Pusher		Truck-Shovel	
	Hard Material	Dirt	Hard Material	Dirt
Load Time	1.30 Min	.90 Min	3.50 Min	3.00 Min
Dump Time	.30	.25	.20	.20
Spotting (Twice)			.40	.30
Turns & Acceleration	.70	.70	.60	.60
Wait Time	.20	.15	.30	.20
Fixed Time	2.50 Min	2.00 Min	5.00 Min	4.30 Min
Haul Time, 3,000 ft	2.85	2.85	2.27	2.27
Return Time, 3,000 ft	2.27	2.27	1.70	1.70
Travel Time	5.12 Min	5.12 Min	3.97 Min	3.97 Min
Total Cycle Time	7.62 Min	7.12 Min	8.97 Min	8.27 Min
Trips per 50 Min Hr	6.56	7.02	5.57	6.05
Pay Cu Yd per Trip	16 cys	21 cys	18 cys	20 cys
Production per 50 Min Hr	104.9 cys	147.4 cys	100.3 cys	121 cys
Hauling Units in Fleet	4 Scrapers	5 Scrapers	3 Trucks	3 Trucks
Fleet Prod per Hr.	419 cys	737 cys	301 cys	363 cys
Total Fleet Cost per Hr	100%	90%* (no ripper needed)	70%	65%* (no compressor & drill needed)
Cost per pay cu yd	.239%	.122%	.232%	.179%

*In addition to equipment changes in both fleets working dirt, costs for maintenance and repairs are reduced.

DENVER Steel Head MILLS

When you compare specifications point by point, we are sure you will agree with all those who in recent months have specified DENVER over all other mills. You get

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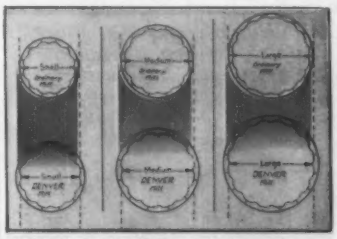
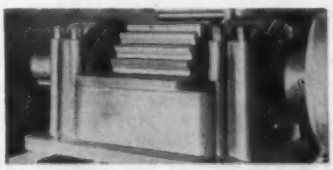
NOW—sizes up to 10' dia. (inside liners) by 20' long. Your choice of liner design. Manganese steel is standard, other alloys available.

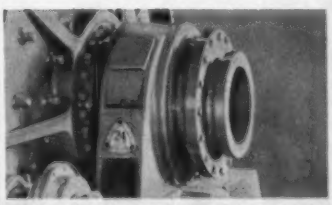
CAST STEEL HEADS — DENVER Mills have cast steel heads—many times stronger than cast iron. Why risk head or trunnion breakage? Shells are heavy welded steel plate.



MORE CAPACITY—Working diameter is determined by measuring *inside* new liners—not inside the mill shell. You get more grinding capacity for your investment.



PINION BEARINGS are self-aligning, anti-friction type, in cartridge type carriers and mounted in one-piece housing which is bolted to adjustable trunnion sole plate for perfect, permanent alignment of gear and pinion.



TRUNNION BEARINGS are ball and socket type, sealed to exclude dust, with continuous lubrication from oil reservoir in base.

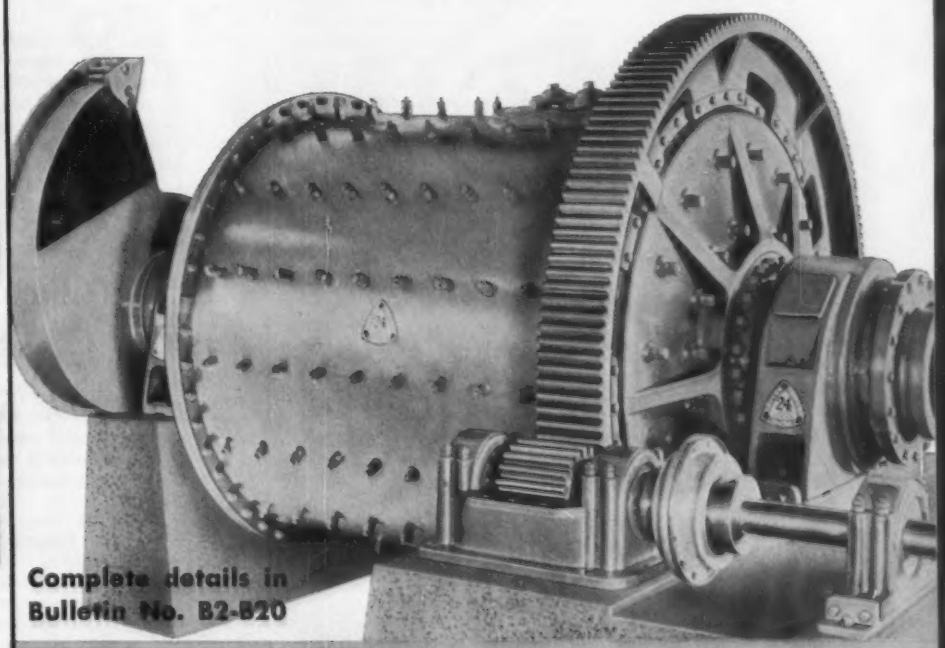
Proper Size and Type of Grinding Mill Starts with DENVER Grinding Test Service

No cost to you for this preliminary test service!

We will tell you the exact size of mill you require, mill cost, power requirements, mill production and proper size of auxiliary equipment.

Send 25 or 50 lb. sample of material prepaid to Denver Testing Laboratory, 1755 Blake St., Denver, Colo., for your preliminary test.

There is no charge to you for this service and information from this test will help you in your decision.



Complete details in Bulletin No. B2-B20

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OPERATING IDEAS *(Continued)*

Thermistor Thermometer Picks Out "Hot Spots" in Drill Holes

A NEW THERMISTOR THERMOMETER has been developed to solve one of the major problems of blasting in hot ground—fluctuating temperatures in the hole.

Cold holes may change to hot rather quickly and holes may also have hot spots that are not detected by mercury thermometers. Mercury units are comparatively slow acting and must have at least a 10-minute contact with the portion of the hole that is being measured. Furthermore, they lose temperature while being withdrawn from the hole and while being wiped clean for reading.

The new thermistor thermometer developed by an Australian mines inspector, O. Anderson, for the Mt. Morgan mine, Queensland, has been used for six months and seems to be the solution to the hot hole problem.

Measurer consists of a bead-type thermistor (100,000 ohms at 20°C and 100 ohms at 300°C), a resistance temperature graph and an ohmeter with two ranges—the 100-250,000 ohms range is used. Calibration by a series of tests is not necessary because the corresponding temperature is known and could be marked on the dial from the resistance reading.

The resistance range covering the temperatures involved is high. Advantages are that:

a) the resistance of leads, even for long holes, would have a negligible effect on the reading

b) the current flow would be low and could not add further heat to the element—giving a greater degree of reliability.

Thermistor is set at one end of a tamping rod through which the leads are run. The ohmeter is mounted at the other end and run by a thumb switch. (Future versions will have sections of tamping rod with end fittings designed to be screw coupled, maintaining electrical contact, and to be used for any length of hole.) The thermistor is protected by an open metal shield. A simple resistance measuring device was made which uses an O-1 millimeter graduated in ohms.

Australian miners are now using the unit whenever there is the slightest possibility of a hot spot in a hole. Mr. Anderson thinks that the thermistor offers other interesting possibilities. It could be used to determine the geothermal gradient in deep drill holes, the temperature and conditions of working places, and even measure air velocities by the change of cooling registered.

Easy-to-Read Chart Spots Pipe Covering Requirements

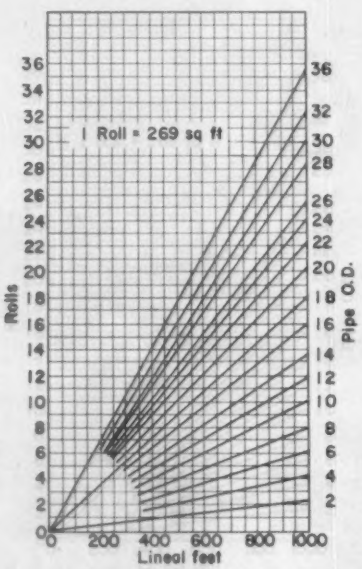
THE ACCOMPANYING GRAPH serves as a quick guide for estimating the amount of aluminum pipe covering needed for any given installation, according to Paul C. Ziemke, Clinton, Tenn.

The chart is read in the following manner:

1. At right side, locate O.D. to be covered (including insulation).

2. Follow pipe O.D. line down and to the left until it crosses appropriate lineal feet line.

3. Read required number of rolls of aluminum covering from the column at the graph's left margin.



Note: Normal longitudinal and circumferential laps have been computed and included in the indicated requirements.

Climax Designs New Core-Splitter

HYDRAULIC CORE-SPLITTER, resembling a guillotine, and consistently cutting solid cores into nearly perfect halves, is being used by the geology department of Climax Molybdenum Co., according to an article in the August 10th issue of Moly Mountain News.

Climax personnel said that the new device is used in connection with their diamond-drilling program and is far superior to the manually operated core-splitter that had served them for 23 years. (cores were then split by turning a screw device, with tough pieces getting additional pressure from a single jack). The old machine had a capacity of about 200 ft of rock per day—new one can split nearly 400 ft during an 8-hr period.

The efficiency of the splitting operation has also been increased by devising a new bench for holding the incoming core boxes and trays.

The article went on to say that the core-splitter is "believed to be the only one of its exact kind in the world" and that "patent rights for the device have been applied for by the company."

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of materials handled

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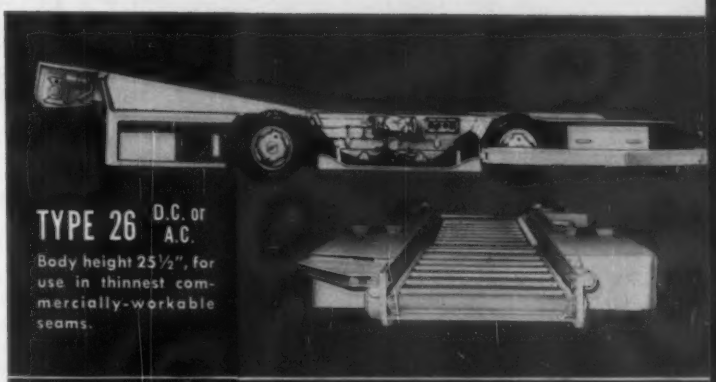
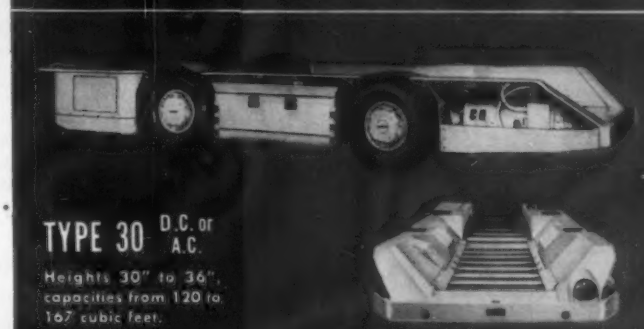
Write *for the informative new TorKar Bulletin and for Specification Sheets on all models.*

The trend is to TorKar



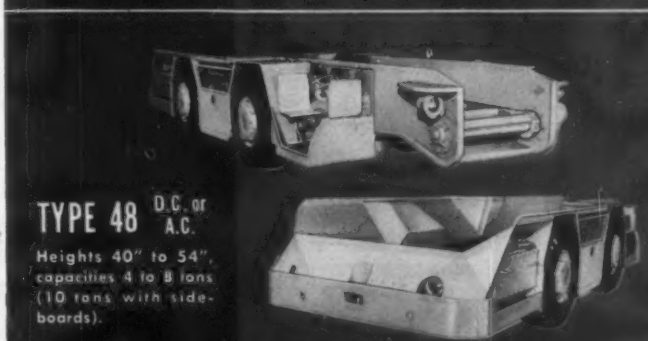
TYPE 26 D.C. or A.C.

Body height 25½", for use in thinnest commercially-workable seams.



TYPE 30 D.C. or A.C.

Heights 30" to 36", capacities from 120 to 167 cubic feet.



TYPE 48 D.C. or A.C.

Heights 40" to 54", capacities 4 to 8 tons (10 tons with sideboards).

TYPE 60 DIESEL

Height 60" Capacity 20 tons. Equipped with patented National Mine Exhaust Gas Conditioner.

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Mining Practice, Processes & Patents

A roundup on what's being written and said, the patents granted, the techniques tried in the mines, mills and smelters.

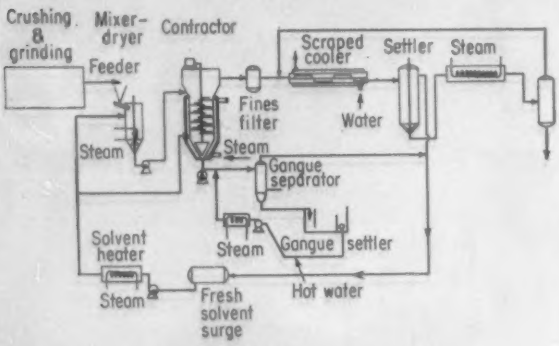
Ion Exchanger Used For Prospecting

CATION exchange resin traps are being used by McPhar Geophysics Ltd. for hydrogeochemical prospecting for metal-bearing orebodies according to a patent granted in Canada to W. J. Wark (579,864 and 579,884). Traps, containing the resins, are set in natural drainage systems, later collected and analyzed for their metal content.

Aeromagnetic Surveys of Maine Published

TWO NEW aeromagnetic surveys of Maine's mineral potential are now available. One is a survey of portions of Penobscot, Piscataquis and Aroostock Counties, entitled GP&G No. 4. Area was flown by the James W. Sewall Co. for the Maine Geological Survey. It included 35 parallel flight lines averaging 22 miles in length at 1-mile intervals. Booklet contains eight pages of data, base maps, profiles, geologic map, aerial photo index and photogeologic interpretation map. Price is $1.15 plus 3c sales tax for in-state purchase.

Second reconnaissance is of the Sidney-Augusta and Gardiner areas, Kennebec County, titled GP&G No. 5. Survey includes two small areas totalling about 46 sq miles for which 45 short flight lines at one-quarter mile intervals were required. Booklet of 11 pages contains text, base maps, magnetic plans and profiles, etc. Cost is $1.88, plus 5c in-state sales tax. The publications may be obtained from the Maine Geological Survey, Dept. of Economic Development, State Office Building, Augusta, Maine.



Fuel Oil Solvent Dissolves Sulphur

MANY METHODS have been tried and patented to recover native sulphur from ores, but most of them have proven to be costly or difficult to perform in actual practice. The most recent new process is the Delhi-Taylor Oil Corp. process developed by Joseph W. Bartlett and Elton D. Soltes (U.S. Patent No. 2,890,941). In the process, sulphur-bearing ore is mined, ground and fed to a solvent (fuel oil) and heated above the boiling point of water to dissolve all the sulphur. Hot slurry is contacted with a second batch of solvent in a countercurrent fashion. Next, the slurry is contacted with hot water to separate fuel oil and its sulphur load from the ore particles. Fuel oil solvent is cooled, the sulphur precipitated and is collected, while the solvent recycles to the process.

Along the same lines, R. G. Capell, J. H. Wright and W. A. Gruse of Gulf Research & Development Co. have obtained a patent for solvent extraction of sulphur from leviathan deposits in which the solvent is an organic polysulphide which complexes the elemental sulphur (U.S. No. 2,897,065).

Ferric Chloride Uranium Leach

TWO METALLURGISTS for the U.S. AEC have been granted a patent (No. 2,894,804) on a process that employs ferric chloride to extract uranium and radium from siliceous ores. Leach solution is filtered and the uranium precipitated with suitable reagent, such as $BaCO_3$. Residual solution is treated with H_2SO_4 to throw down uranium. Authors are C. W. Sawyer and R. W. Handley.

Agglomerating Gravel Magnetite

GRAVEL MAGNETITE deposits in the Lazio, Italy area have proved difficult to smelt successfully, or for that matter, even to sinter. The Instituto Siderurgico Finsider, Corso F. M., Perrone 24, Genova Cornigliano, Italy conducted a series of experiments which showed that when gravelly magnetite is agglomerated with an equal part of pyrite ash, 8% coke and 13 to 14% water, sintering can be conducted economically. Tests with lignite instead of coke produced too much dust, low production and high ash content of sinter. The addition of rolling mill scale up to 20% by weight slightly increased the agglomeration time but did not change the production rate (it did improve particle size), according to G. Sironi "La Influenza Della Composizione Delle Miscele Sulle Caratteristiche Delle Agglomerazione" in LA METALLURGIA ITALIANA, Vol. 50, No. 5, May 1958 pp 181-190 (in Italian).

Bureau Gets Alumina From Laterites

IF THE PROCESS PROVES SUCCESSFUL—economically as well as technically—the U.S. Bureau of Mines' alumina-from-clay process may give a boost to aluminum producers in the Salem, Ore. area. Process yields alumina, and could produce a low-phosphorus iron and a titanium dioxide residue. One company, Harvey Aluminum, has, according to CHEMICAL WEEK, voiced interest in the Bureau process, but says that iron recovery and disposal will probably be necessary before the process becomes economic. Oregon laterites assay 30 to 35% aluminum, 26 to 34% iron oxide with remainder silica and titanium. Phosphorus is 0.6%.

First step is to calcine the ore at 1,050° C. Key to the process is a double caustic leach in which 60 to 70% of the silica is removed with 10% caustic at 90°C. Then the solution is treated with lime at 100°C to precipitate silicates and phosphates and regenerate caustic. Second step is a leach in 30% caustic at 210°C and 265 psi to dissolve the alumina which can be purified by conventional alumina techniques (See May 1959, E&MJ, Reynolds' alumina process). Alumina yield in the Bureau process is 82 to 87% on 16% silica ore. Residue runs high in titanium and iron. USBM estimates that four tons of ore would yield one ton of alumina.

Tapping Lead Furnaces Continuously

INSTEAD of intermittent tapping and plugging of the contents of a lead blast furnace, American Smelting & Refining Co. has developed a continuous tap-out system that

(*Continued on p 124*)

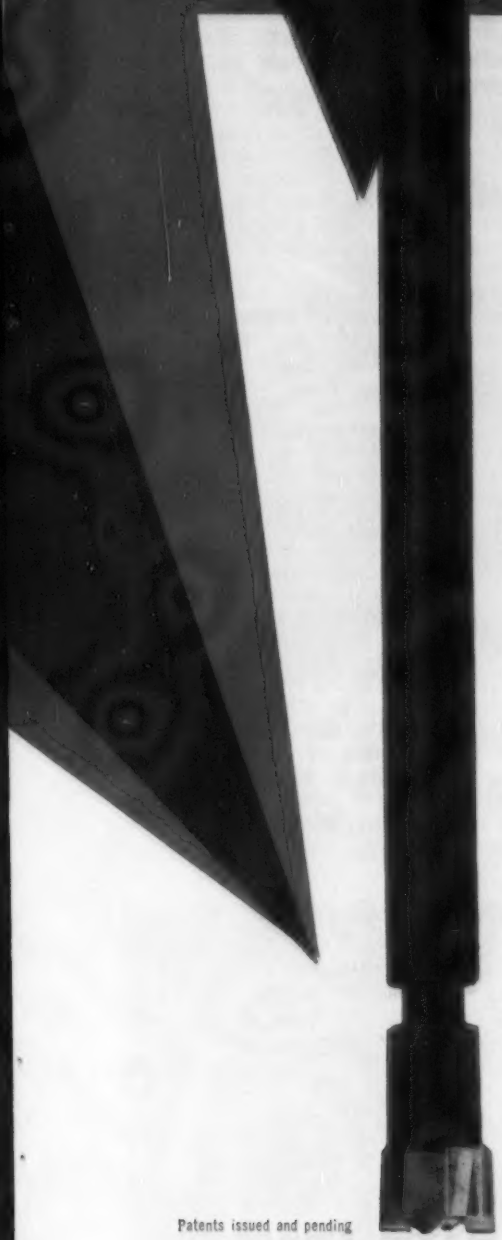
Drills up to 30 feet an hour in granite

MISSION HAMMERDRIL

Trade Mark

Hole Impact Tool

The Mission HAMMERBIT



Patents issued and pending

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The Mission HAMMERDRIL is sold and serviced throughout the United States. Write to Mission for more information on what the HAMMERDRIL can save you—actual field savings under field conditions.

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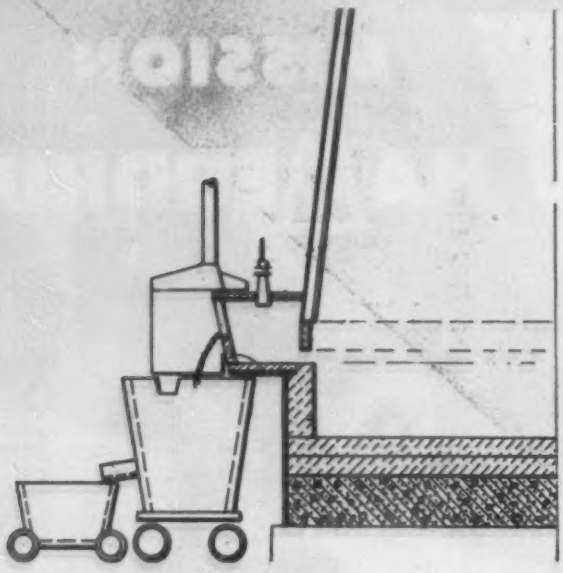
improves the process metallurgy, cuts production costs by eliminating one man per shift, and eliminates the cost and need for iron bars and oxygen lances. In addition, the patent application (U.S. No. 2,890,951) says that the invention has caused savings in coke, scrap iron and has resulted in lower lead losses in the slag.



Continuous tapping is done as illustrated in the drawing above with a tapping bay built onto the outside of the base of the blast furnace. The molten bullion and slag continually flow through the open breast into the bay, overflowing a notch-shaped weir at the end of the bay, dropping the bullion into the slag settling chambers. A gas burner is provided to maintain temperature in the bay, and the sides of the bay are high enough to handle all possible changes in furnace level. Changes are made in the height of the notched weir in accordance with changes that occur in the height of the bullion in the furnace and changes in blast pressure to the furnace. Changes are made by adding or taking away of adobe clay from the v-notch, according to J. T. Roy, the inventor, now manager of Asarco's Selby, Calif. Smelter.

Concentrating Brine

ELECTRODIALYSIS of sea water gets a reverse twist this month as Ionics, Inc., Cambridge, Mass., ships to Japan a pilot unit for boosting the salt content of sea water.

With no native salt deposits, Japan is dependent on the sea or on imports for its salt supplies. The country imports about 2-million tons of salt annually. The commodity is under strict government control.

The new unit is designed to produce a concentrated brine stream carrying 1 tpd of salt. It will be operated by Asahi Electro-Chemical Co., a government-approved licensee under Ionics' Japanese patents. Another Japanese firm, New Japan Chemical Co., has announced its intention of producing 50,000 to 60,000 tpy of salt via this route, pending government okay. The latter company hopes to reduce costs to around half their present level, a goal which Ionics considers attainable, according to McGraw-Hill.

A sea water concentration unit differs little in construction from an electrodialysis unit designed to convert salt water into fresh. The latter discharges a large waste stream, slightly enriched in salt content, while turning out a smaller primary stream of fresh water. In the new unit the primary product will be greatly enriched in salt content (15-25%), while the much larger waste stream will be only slightly depleted in salinity.

Can the same unit serve a dual function, producing both concentrated brine and fresh water? It's possible, says Ionics, but not economically practical.

How Surface Affects Zinc Deposition

TWO RUSSIANS, D. P. Zosimovich and T. J. Konochuk, report in ZHUR. PRIKLAD. KHIM. Vol. 30, No. 2, pp 240 to 248, 1957, the results of their work on the influence of oxide films on zinc metal adhesion to aluminum cathodes. Four types of cathodes were tested—a rolled cathode (to which the zinc would not adhere), one etched in alkali until the structure appeared (strong adhesion even under high fluoride concentration), one etched and passivated in 20% H_2SO_4 for 20 minutes at 12 v and 25°C (no adhesion), and a fourth that was electropolished (excellent adhesion).

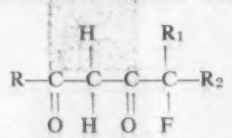
The electrolyte contained 60 gm/l zinc, 0.5 to 3 N H_2SO_4 and from 25 to 500 mg/l of fluoride ion. Electrolysis was conducted at 30°C and 500 amp/m². The authors credited the strong adhesion to the oxygen-free surface on the alkali-etched and the electropolished samples.

Along the same lines, V. L. Klimenko (ZHUR. PRIKLAD. KHIM. Vol 30, No. 4, pp 533 to 546, 1957) reports that cathode stripping difficulties are related to the surface condition of the cathode as well as to fluoride concentration. He notes that damaged or notched material is difficult to strip even in fluoride-free electrolytes.

Klimenko separates the impurities found in zinc electrolytes into three groups—those that cause changes in the zinc microstructure, set up internal stresses, change the current efficiency and reduce adhesion—Sb, Sn, Bi and Pb; those that do not change structure, but do form microcells and discourage stripping—Co, Cu and Ni; and those that do not affect structure, stripping or efficiency—Cr, Mo, Cd and V. Additions of up to 200 gm/l Fe caused some changes in microstructure and efficiency, but did not affect stripping. Addition of chlorine did not affect the aluminum cathodes, but it did dissolve the Pb anodes. Stripping was not affected by changes in current density in the 200 to 1,100 amp/dm² range.

Solvent Extraction For Zirconium

H. W. CRANDALL AND J. R. THOMAS have been granted a patent, assigned to the U.S. AEC, which makes 22 claims involving the separation of zirconium or salts of zirconium from mixtures containing the metal, columbium, rare earths and alkali earth metals. Process is solvent extraction using a fluorinated B-diketone having this general formula:

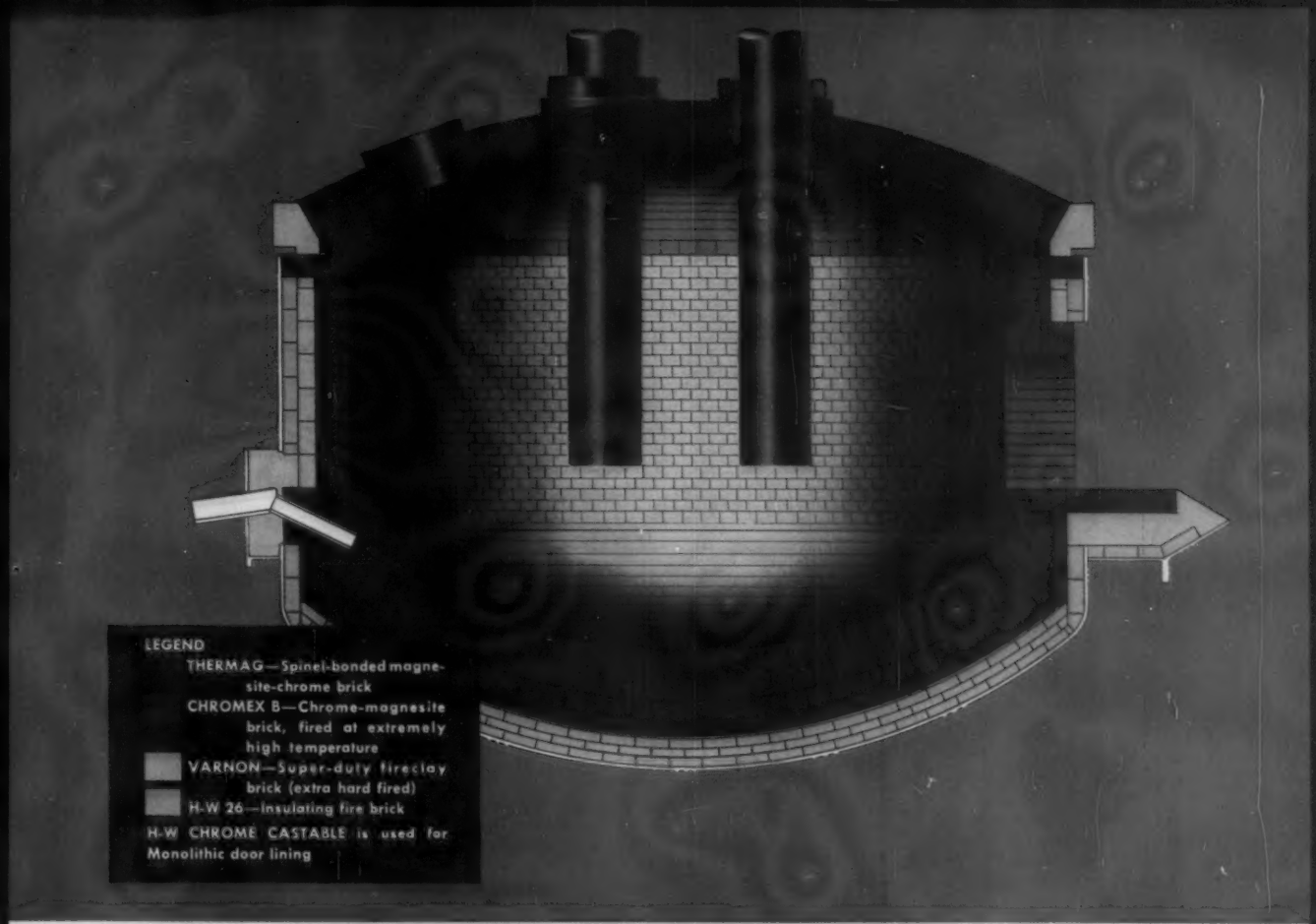


Organic solvents for the liquid exchanger are benzene, xylene and hexone according to U.S. Patent No. 2,892,681.

Fused Salt Electrolysis of Battery Scrap

LEAD CAN BE recovered in compact form on iron cathodes in an electrolytic cell using a fused NaOH bath according to Yu K. Delimarsky, P. P. Turov and E. B. Gitman in UKRANIUM KHIM. ZHUR. Vol. 23, No. 6, pp 817 to 822,

(*Continued on p 126*)


LEGEND
THERMAG—Spinel-bonded magnesite-chrome brick
CHROMEX B—Chrome-magnesite brick, fired at extremely high temperature
VARNON—Super-duty fireclay brick (extra hard fired)
H-W 26—Insulating fire brick
H-W CHROME CASTABLE is used for Monolithic door lining

Harbison-Walker refractories used in the world's largest

ELECTRIC COPPER MELTING FURNACE

at American Smelting and Refining Company, Perth Amboy, New Jersey

Exterior view of world's largest electric copper melting furnace (courtesy of ASARCO)

The Harbison-Walker refractories which are particularly suited for use in the different furnace positions as here graphically illustrated, assure long, economical service. These brands are making records in electric copper melting furnaces at various refining plants.

THERMAG and CHROMEX B brands are selections for this electric furnace requirement, from a full score of Harbison-Walker basic refractories, many of which are widely used in copper smelting and refining practice. Among these, several of the leaders are:

- CHROMEX B—giving outstanding service in anode and wire-bar furnace side walls and in converters.
- METALKASE—steel encased basic brick, both plain and internally plated. Made in various sizes and in suspended arch shapes used for roofs of refining and matte smelting furnaces.
- H-W MAGNESITE—consisting predominantly of stabilized periclase. This brand of refractory provides the most strongly basic linings for greatest resistance to severe fluxing by basic slags.

In addition, Harbison-Walker products include all types and classes of refractories for every metallurgical furnace need.

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1957. Material used successfully included battery scrap, PbO, PbO_2 and $PbSO_4$, but the $PbSO_4$ had to be converted to the oxide by reaction with 2% excess soda prior to its addition to the fused electrolyte.

Sulphur Recovers Sulphur

TEXAS GULF SULPHUR CO. has found another way to use elemental chlorine to produce elemental sulphur and metal chlorides from sulphide ores that gets around many of the difficulties inherent in chloridizing roasters and kilns—use a solvent that will dissolve the sulphur and the chlorine. One of the best solvents turns out to be sulphur. Organic compounds also are cited, but the examples given employ molten sulphur to dissolve the chloride and the sulphur produced by the reaction with the sulphides. Patent has been issued to Cyril Thomas Hill (U.S. 2,895,796) which employs low temperature chlorination (100 to 400° C) in presence of molten sulphur at atmospheric or higher pressures. Decomposition of the chloride with air or oxygen returns the chlorine to the process and yields a metal oxide.

At the same time Hill has been granted a patent on his method of recovering the germanium tetrachloride produced through the chlorination of the above metal sulphide ores or concentrates. The germanium salt boils at about 86°C, so it is a simple matter to keep the operating temperature above that level and to sweep the germanium tetrachloride out of the reactor with nitrogen, SO_2, CO_2 or other gas that won't react with the product. Patent No. 2,895,797 cites examples using sphalerite and other sulphide zinc concentrates in which more than half of the germanium is recovered.

Additional U.S., Canadian & British Patents Briefly Noted

Patent information is provided E&MJ by Oliver S. North, patent consultant, Washington, D. C. Mr. North also scans and abstracts the patents issued in Canada and Great Britain which appear below and which will appear in forthcoming issues of E&MJ U.S. patents may be obtained from the Commissioner of Patents, Washington 25, D. C. (25¢ each); British patents from the Patent Office, London; and Canadian from the Patent Office, Ottawa.

Recent U.S. Patents

Electrostatic recovery of nonmetallics (International Minerals & Chemicals Corp.) 2,889,042
Centrifugal concentrator 2,889,044
Pelletizing disk (Metallgesellschaft) 2,889,576
Ore sampling device (Marcona Mining Co.) 2,889,709
Direct reduction (Dorr-Oliver Inc.) 2,890,106
Attrition and flotation of uranium (Dering) 2,890,795
Recovery of manganese (C.C. Daugherty) 2,890,103-4
Sinter cooler with conveyor (Metallgesellschaft) 2,892,265
Volatilizing germanium monoxide (O. Rosner) 2,892,700
Producing lithium chloride (International Minerals and Chemicals Corp.) 2,893,828
Electrolytic titanium (Monsanto Chemical Co.) 2,893,835
Solvents for thorium and uranium (U.S. AEC) 2,894,827
Chemical protects stockpile (American Cyanamid) 2,894,851
Separating columbium-tantalum with fluoride ion (Mallinckrodt Chemical Works) 2,895,792-3
Aerial geophysical exploration with a scintillation spectrometer (Lundberg et al) 2,897,368
Janelid mining method (See E&MJ, July 1959) 2,896,929
Solution mining of uranium ores (J. R. Menke) 2,896,930
Solvents for thorium-uranium (E. G. Bohlmann) 2,897,046
Germanium sulphides from fly ash (C. F. Reed) 2,898,188
Calcining magnesite to magnesia (Eells et al) 2,898,194
Ion exchange for rare earths (S. Jaffe) 2,897,050
Blast furnace design (J. M. M. Augeard) 2,897,984
Air milling asbestos (H. Hardinge) 2,899,139
Sulphating laterites (R. P. Bailey) 2,899,300
Roast and leach to separate rare earths in bastnaesite (H. E. Kremers et al, American Potash & Chemical Corp.) 2,900,231
Producing anhydrous titanium tetrafluoride from ores or minerals (R. B. Jackson et al) 2,900,234
Iron and TiO_2 from ores (M. J. Udy) 2,901,341
A dialkyl thiophosphoryl bromide froth flotation agent for treating a mineral pulp produced during the leach precipitation flotation process (A. H. Fisher, Minerec Corp.) 2,901,107

These U.S. Patents Have Expired

Fuming antimony (American Ore Reduction) 2,295,039
Treating siliceous slags with iron sulphides to throw down precious metals 2,295,219
Floating phosphate minerals with cationic collectors (American Cyanamid Co.) 2,295,459
Roasting fine pyrite (General Chemical Co.) 2,297,307
Floating langbeinite (Phosphate Recovery Corp.) 2,297,664
Producing ferromanganese briquettes (Minerals & Metals Corp.) 2,291,685
Iron and sulphur from sulphides (Thomsen) 2,292,305
Direct reduction of iron ore (Standard Oil) 2,292,579
Desliming phosphate (American Cyanamid) 2,293,033
Cyanide-gold process (Southwest Engineering) 2,293,066
Film flotation of phosphate (American Cyanamid) 2,293,469
Floating silica (American Cyanamid) 2,293,470
Floating phosphate (Arthur Crago) 2,293,640
Sponge iron or iron powder using HF to evolve silica (Fahrenwald) 2,293,939
Refining copper-bearing anode slimes (Nassau Smelting & Refining Co.) 2,294,053
Block caving method (M. A. Smith) 2,298,599
Floating feldspar or kyanite 2,297,689
Floating phosphate (Armour & Co.) 2,298,281

What's New in Canadian Patents

Glue and polyvinyl alcohol in copper electrolyte (J. H. Schloen et al., Canadian Copper Refiners Ltd.) 578,988
Treating titanium bearing slags (R. J. Magri et al, American Cyanamid Co.) 579,018
Pelletizing disk (L. Selig, Metallgesellschaft) 579,205
Roasting, smelting and acid leaching of nickel sulphide (J. W. Donaldson et al, Quebec Metallurgical Industries) 579,219
Briquetting ores (E. K. Plant) 579,401
Removing iron from titanium materials (F. O. Wienert, Union Carbide & Carbon Corp.) 579,425
Ion exchange for gold and copper (T. V. Arden and G. A. Segar, Permutit Co. Ltd.) 579,633
Sintering plant (N. J. D. Nilson and A. Holmberg) 579,740
Titanium and iron from ilmenite with soda ash roast (O. Moklebust, National Lead Co.) 579,814
Low-temperature smelting of manganese-containing ores using manganese as a flux (M. J. Udy) 580,244
Acrylic or polyacrylic acid added to leach pulp to prevent agglomeration (D. J. I. Evans and P. T-I-Chiang, Sherritt Gordon) 580,508

The Latest British Patents

Briquetting iron ores (Klockner-Humboldt-Deutz) 814,344
Electric smelting of aluminum and purification of off-gases (Electrokemisk) 814,413
Using a cyclone to remove arsenic or antimony from roaster gas (Badische Anilin & Soda-Fabrik) 814,707

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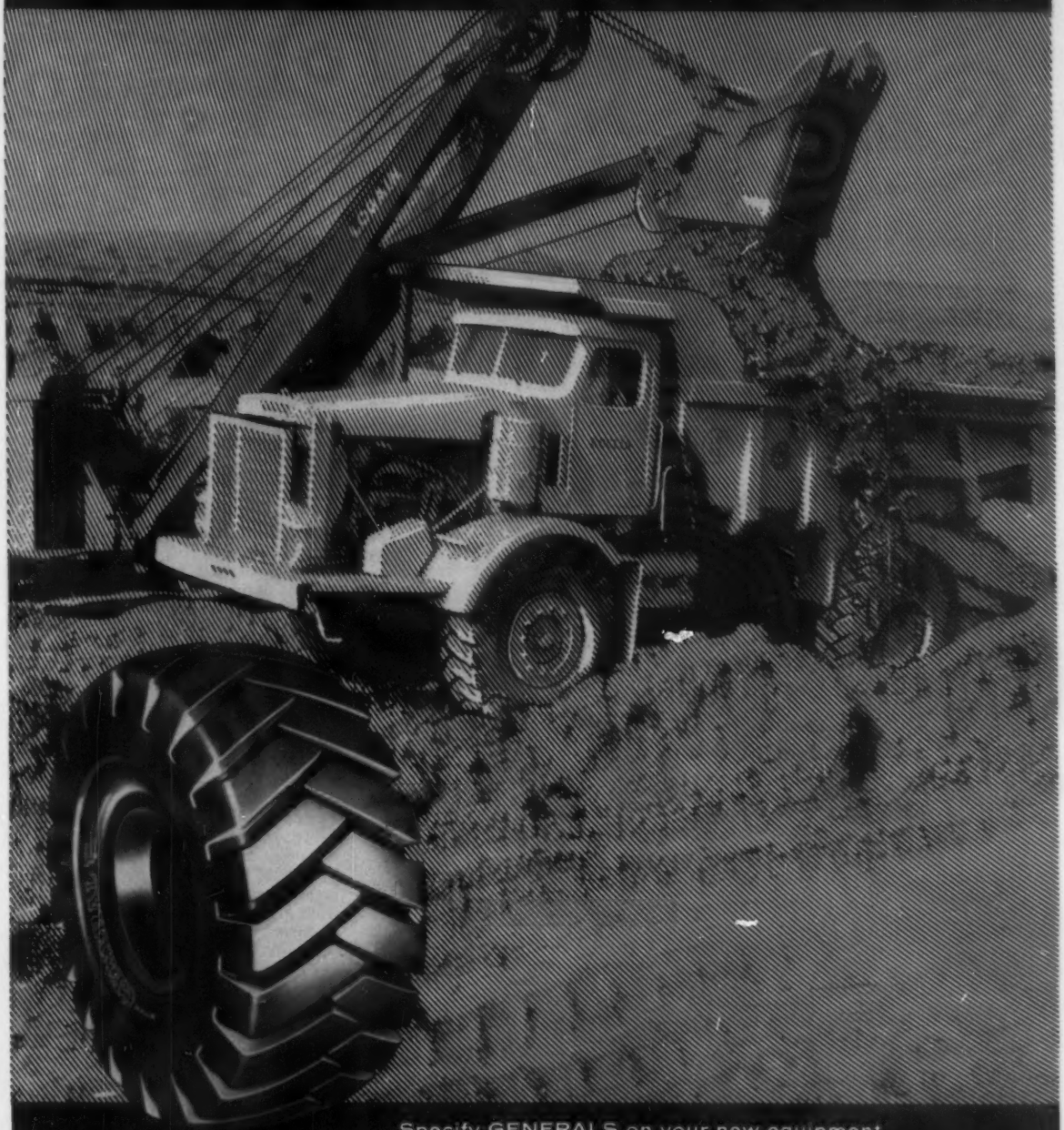

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World Iron Ore Figures Published By British

AN APPRAISAL of world iron ore supplies published in September 1951 by the British Iron & Steel Federation was revised and republished in January 1959. The report, containing 18 pp, discusses changes in the iron ore supply pattern since 1951 and has considerable detail on the types and grades of iron ore resources, according to USBM.

Principal table on world reserves from the report is reproduced here. The reserves include, in most instances, proved, probable and possible ores. Due to condensing the information into one table, USBM notes that the figures should be taken as approximations.

World Iron Ore Reserves

(In millions of tons)

Country	Direct Shipping ores	Ores needing beneficiation	Iron content
North America:			
Canada	6,635	7,000[1]	5,327
United States	4,500	60,400	20,086
South America:			
Argentina	80	105	82
Bolivia	500		250
Brazil	16,250	36,000[1]	20,925
Chile	190	500	269
Colombia	105		50
Cuba	3,000[2]		1,200
Dominican Republic	43		28
Mexico	500		300
Peru	740		407
Puerto Rico	100		50
Venezuela	2,200	[3]	1,430
Europe:			
Austria	340		115
Belgium	320	150	136
Bulgaria	20		12
Czechoslovakia	230		75
Finland		80[4]	30
France	8,350[5]		2,861
Germany	1,510		455
Greece	70		33
Hungary	20		9
Italy	30		16
Luxembourg	270		78
Norway	50	1,440	506
Poland	370		110
Portugal	10		4
Rumania	100		56
Spain	1,000		510
Sweden	2,400		1,513
Switzerland	80		24
United Kingdom	4,600		1,215
USSR	33,757	23,984	18,928
Yugoslavia	140		58
Africa:			
Algeria	500		270
Egypt	188		109
Gabon	750[6]	[3]	450
Africa: *(Cont.)*			
Guinea	2,500[6]	[3]	1,550
Liberia	1,000[6,7]	[3]	600[7]
Mauritania	120	[3]	77
Morocco	190		91
Northern Rhodesia	50	[3]	32
Senegal	100		60
Sierra Leone	200	[3]	120
Somaliland	100		55
South Africa	3,500	[3]	1,600
Southern Rhodesia	144	[3]	86
South-West Africa		300	120
Swaziland	62		40
Tunisia	55		28
Asia and Australasia:			
Australia	720	[3]	419
China	4,180	7,000	3,576
Hong Kong	10		4
India	21,300	85,000[6]	37,940
Indochina	100		60
Indonesia	850[2]		400
Israel	15		5
Japan	27	37	27
Korea		406	150
Malaya	55		33
New Caledonia	18[2]		8
New Zealand		496	250
Pakistan	60		36
Philippines	1,330[2]		641
Turkey	140		70

1. Underestimated
2. Mainly laterites
3. Not estimated, although large taconite deposits exist
4. Excluding titaniferous ores
5. Excluding potential ores
6. Deposits not fully mapped; estimated
7. More than 1,000

Federal Finds Silver At Conjecture Mines

"A PROFITABLE MINE for 20 years or more" is the assessment which Ralph W. Neyman, president of Federal Uranium Corp. placed on the Conjecture Mine, near Lakeview, Ore. which reported a find of 200-ft thick silver ore.

In reporting the discovery to stockholders at the annual meeting, Mr. Neyman said that the vein dips diagonally and is more than 200 ft thick at 1,000 ft. He said the ore was of good commercial grade and that production would start next year. A mill will be built in the early spring on the property, on which Federal has already spent about $1-million.

Federal operates the mine under an agreement with Conjecture Mines Inc. of Spokane and will share in profits. "We now have a commercial silver mine," Nels W. Stalheim, chairman of the firm, said.

Salt Lake Tungsten To Produce Paratungstate

SALT LAKE TUNGSTEN CO. proposes reopening its refinery at Salt Lake City on commercial basis for production of high purity tungstate.

Minerals Engineering Co., Grand Junction, Colo., has purchased the 50% interest in the plant from Sylvania Electrical Products, Inc., said Blair Burwell, Sr., president of both Minerals Engineering and Salt Lake Tungsten.

The plant, which was closed for 18 months during period of world oversupply of WO_3 and consequent low prices, will produce an ammonium paratungstate at rate of 20 tpd when on commercial basis, Mr. Burwell said.

It currently is producing two to five tons daily. Sylvania continues in purchase position for the paratungstate which forms the basis of powder tungsten metallurgy and production of ductile tungsten.

Production of 5,000 units (20 lb each) depended on the end of the steel strike.

Mr. Burwell said that a nitric acid digestion unit which removed copper, lead and phosphorus impurities from tungsten concentrates was being moved from a mile away to the refinery, which employs autoclave-hydrochloric acid treatment to remove molybdenum values down to .001% moly from the artificial scheelite.

Burwell said that with end of the steel strike Minerals Engineering's Calvert Creek, Mont., open pit tungsten mine and mill would be placed back in production. This operation produces a concentrate running about 50% WO_3 for the Salt Lake refinery. Also, Burwell said that Salt Lake Tungsten was prepared to buy, from independent mills, tungsten concentrates running as low as 40% WO_3.

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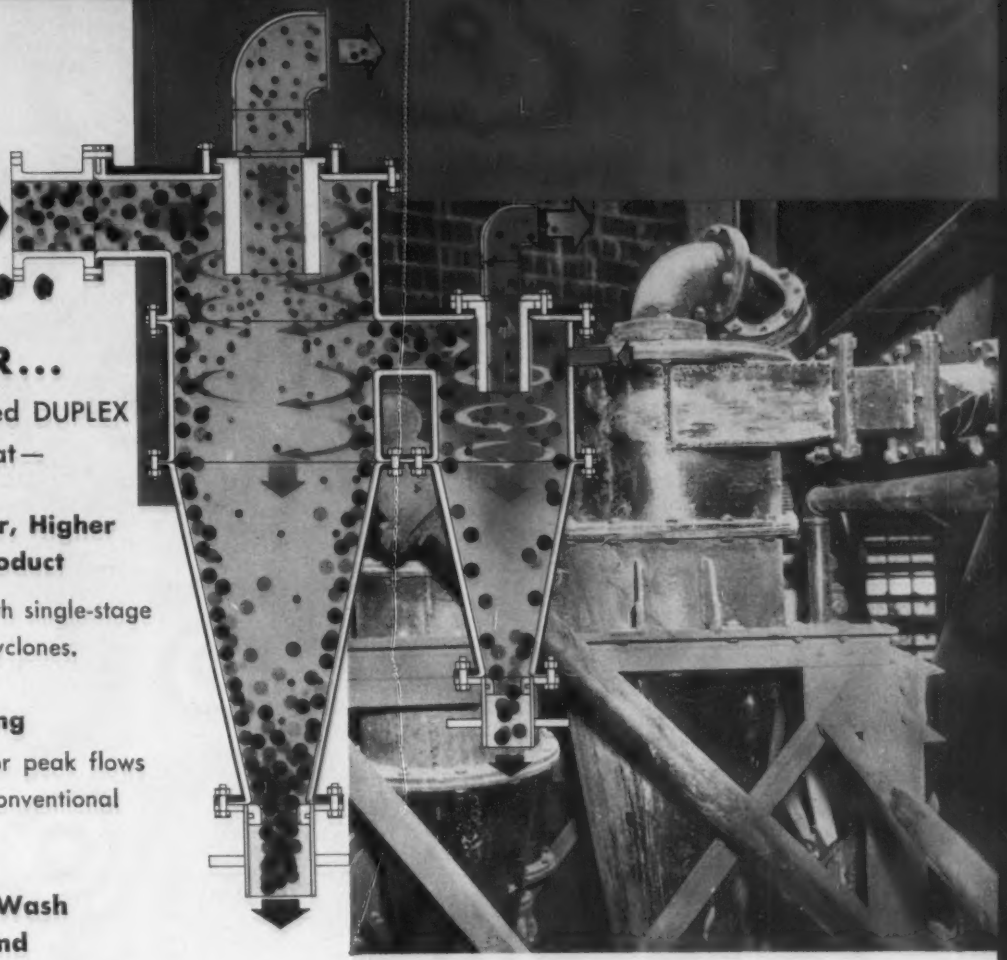

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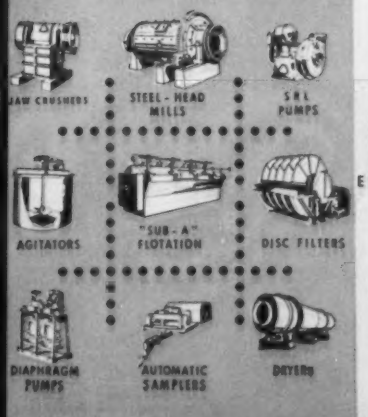

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UNITED VERDE smelter at Clarkdale, Ariz. will be the site of a 500-tpd Udy Process steel mill. Webb & Knapp also will build a larger one at Anaconda, Mont.

Steel Mills Slated For Arizona and Montana

AN INTEGRATED steel mill will be erected in Arizona—Webb & Knapp, Inc., have announced the formation of Webb & Knapp Strategic Corp. and the purchase of the entire town of Clarkdale, Ariz. and the abandoned United Verde property.

The mill will recover copper, zinc and iron from the copper smelter slag —an estimated 30-million tons exist. This is the first time that a steel mill in the U.S. will be based on copper smelter slag (In Canada, Cominco has announced plans for a furnace to produce electric steel from zinc slag). The copper will be refined; the iron processed into semi-steel, finished steel and fabricated mill products. In addition the slag-slag—the final tailings from the second smelting step in the Strategic-Udy Process—will be processed into lightweight aggregate and building materials.

Webb & Knapp also announced the purchase of the slag pile and daily production of hot slag (about 3300 tpd) from Anaconda Co.'s operations at Anaconda, Mont. A second steel mill will be erected here.

Third company in the venture is Koppers Co. which joined with Strategic-Udy several years ago to develop the Udy Process. (Marvin Udy the inventor, past president of the Electrochemical Society and former Battelle employee died earlier in 1959). Smelter town and surface plant cover about 1200 acres. Webb & Knapp estimate that about $15-million will be required to develop the Clarkdale operation to full capacity in two years.

Strategic-Udy will hold a 15% interest in Webb & Knapp Strategic Corp. which has exclusive rights to the Udy process on copper slags.

Tests of the Clarkdale material at Udy's Niagara Falls, Ontario pilot plant have been successful and led to the announcement of the twin projects. The slag runs about 33% Fe, 0.5% Cu and 2% Zn. Initial capacity will be 500 tpd of steel, 1000 tpd of building materials.

Zeckendorf Steel Co.—a Webb & Knapp Strategic Corp. subsidiary—has been formed to operate the properties. Zeckendorf Steel will buy the slag from Webb & Knapp Strategic and process it. The Clarkdale plant will have enough slag to last from 30 to 60 years at present design plans, while the Anaconda plant will have an indefinite life, since the property has a large slag pile present (40-million tons) and is producing about 3,300 tpd of hot slag now. The Anaconda plant will have a cost advantage over the Clarkdale operation in that the slag for the most part will be hot metal. The Montana plant is expected to be onstream in 1963.

At Clarkdale, the ghost town of 200 homes, 3,000 acres has been purchased from the Earl Halliburton estate and will soon become a boom town and the focal point of a rapidly expanding economic influence in Arizona, according to William Zeckendorf.

Beryllium Unit Forms; Announces New Reagent

A NEW REAGENT which "seemingly has the specific ability to float beryl free and clear of other material" is the property of a newly-formed corporation to produce beryllium metal. The new firm, a combination of Radorock Resources, Inc., Federal Uranium Corp., Lisbon Uranium Corp., and Hidden Splendor Mining Co., will be called Dynamic Metals Corp.

The four uranium firms have formed a second company, Beryllium Resources, Inc. to acquire beryl properties and develop them. Bruce W. Odlum, vice president of Radorock, told an annual shareholders meeting that, "It is our hope and belief that this accomplishment (the new reagent) provides the key that unlocks the future to a major metals industry in beryllium."

The current market for beryllium has great potential, but rather limited immediate prospects. Brush Beryllium and Beryllium Corporation of America are reported to have contracted for sufficient ore to fulfill their AEC contracts, and purchases by the U.S. Government have ended.

E&MJ's Washington News Bureau notes that the long- and short-term national stockpile goals for beryl are filled and have been for some time. The Defense Production Act inventory stands closed at 159,000 short dry tons. There are no incentive purchase or other domestic support programs in operation or under consideration.

The Office of Minerals Exploration, successor to DMEA, does have beryl ore on its "eligible" list for exploration and development loans. OME says "several" possible exploration contract negotiations are under review at present.

American Metal Climax Plans Germanium Plant

A GERMANIUM REFINING PLANT at Carteret, N.J. will be constructed by American Metal Climax, Inc. and will be "fully equipped to produce germanium dioxide from both primary raw materials and scrap."

The announcement also noted that basic raw materials are assured by a long-term contract for supplies from Africa.

Freeport Completes Submarine Pipeline

FREEPORT SULPHUR CO.'S molten sulphur pipeline (E&MJ, April, p 132) is now in place on the bottom of the Gulf of Mexico at Grand Isle, La., five months after start of construction. Early next year the pipeline will start delivering up to 4,500 ltpd of molten 320°F sulphur from the new mine offshore to an inshore barge loading terminal.

As described in detail in the April E&MJ the pipeline is actually three concentric pipelines in one with two more outside, all strapped together in a bundle. A 4½-in. and a 6⅝-in. line will carry return water and fresh water respectively to the mine. A 14-in. pipe will carry a 7⅝-in. line inside for hot water and a 6-in. line inside the 7⅝-in. line for molten sulphur. The inner pipes ride on rollers in the 14-in. line, the whole system insulated against heat losses.

The $2-million project was initiated because storms on the Gulf prevented sulphur barges from loading at the mine.

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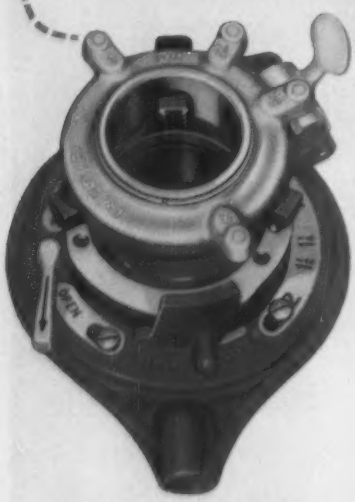

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AEC Uranium Statistics Reported to June 1959

THE U.S. AEC has announced monthly and total statistics on domestic uranium production for the first six months of calendar 1959. Included are figures on uranium concentrates, domestic ore production, rate of processing, ore fed to process, ore stockpiling, ore reserves and initial production bonus payments.

Domestic ore reserves were estimated to total 88.9-million tons on July 1, 1959. In addition, ore stockpiles totaled 1,451,625 dry tons. Ore receipts at all private plants and Government purchase depots in January-June 1959 totaled 3.31-million dry short tons; and ore fed to process totaled 3.614-million tons, with an average grade of .25% U_3O_8. Uranium concentrates received at the Grand Junction depot totaled 8,298 tons U_3O_8 in the six month period.

As of June 30, 1959, there were 23 uranium processing mills in operation, including the single Government-owned mill at Monticello, Utah. Their combined rated daily capacity was approximately 21,740 tons, and their total estimated capital investment was about $138.55-million. Two additional mills with total rated capacity of 1,014 tpd were under construction in Fremont and Natrona Counties, Wyo. The average price paid by the Government for the concentrates was $8.99 per lb. Based on the June production rate, the U.S. will produce about 17,000 tons of concentrate in 1959.

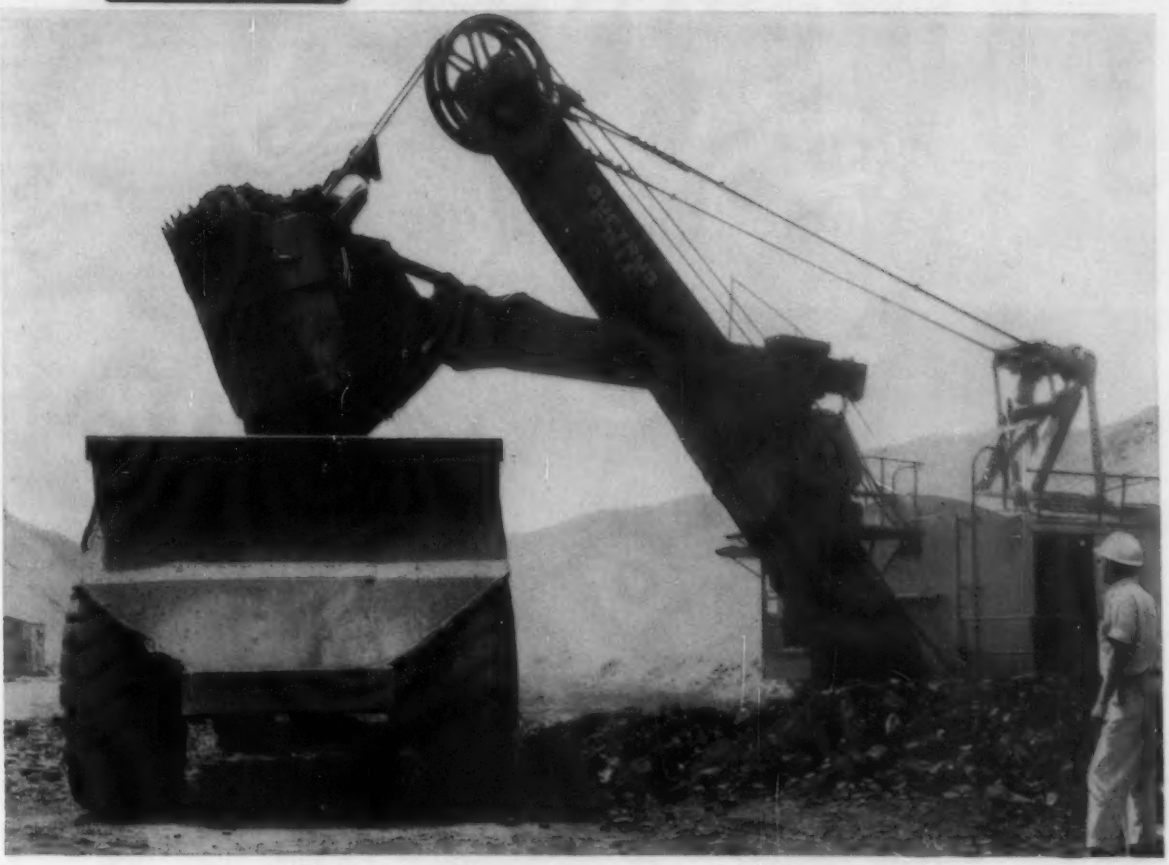
Marinduque's Bagacay Mill To Float Cu-Zn Ore

THE PHILIPPINE P 5-million (US$2.5-million) copper and zinc concentrate mill of Marinduque Iron Mines Agents, Inc. at its Bagacay project in the Philippines was recently christened. The 600-tpd mill is an adjunct to the 2,000 tpd copper, zinc, lead, gold and pyrite mine which ships an average of 1,400 tpd to Japan. The balance of the ore is to be floated at the mill.

Work at the mill site consisted mainly in construction of the crushing, filtering and electrical sections. It is reported that the property contains one of the richest copper and zinc deposits in the country. Ore reserves of the mine are estimated at 3-million tons, which is expected to last from 10 to 15 years based on present rate of production. Exploration teams are examining new reserves which may double the figure.

During May, it was reported that stripping and mining of high grade ore with bulldozer and power shovels was carried forward at the northern and northeastern ends of the Guila-Guila No. 10 pit on the 205-meter bench. Mining of straight shipping ores at the pit floor during the period was not as extensive as planned for establishing a 195-meter bench, due to frequent rains. Low grade ore sent to the mill during the period was taken at the western part of the 205-meter bench near the stripping face and at the northwestern end of the same bench.

B.F.Goodrich



Those B.F.Goodrich tires haul 40 tons of coal over roads made of abrasive limestone

THE Buckheart Mine #17 near Canton, Illinois, is one of many strip mines operated by United Electric Coal Company. Here trucks with 40-ton coal capacity make continuous 8-mile round trips between pit and tipple. Roads are made of abrasive crushed limestone. This could be a real tire-killing job, but the company avoids this costly problem by using B.F.Goodrich Rock Service tires. In fact, B.F.Goodrich tires have been used at Mine #17 since 1938!

B.F.Goodrich builds extra service into the Rock Service tire 3 ways: (1) The tread is extra thick and specially compounded to resist rock cuts and snags. (2) Massive double-chevron cleats defy side-skids, give maximum traction in forward or reverse. (3) A FLEX-RITE NYLON cord body that withstands double the impact of ordinary cord materials. This B.F.Goodrich material resists heat blowouts and flex breaks and means more retreadable Rock Service tires and more retreads per tire.

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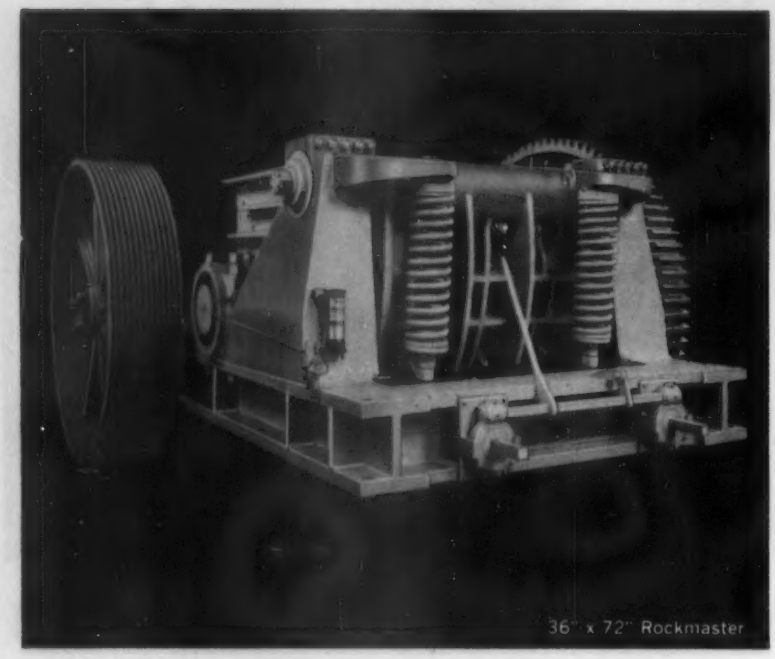

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Marinduque *(Continued)*

About 5,090 wet metric tons of copper ore was mined in all areas and delivered to the loading point at Wright, Samar Province, according to the report.

Two shipments were made from Wright during May, totaling 6,321 wet metric tons averaging 14.03% copper.

At the other sections of the Bagacay project, Sipalay moved 52,825 cu meters, 41,892 cu meters in ore. Ratio of ore to waste was 1:3.83. The eastern orebody supplied 88.5% of the ore from its 10-meter and 15-meter benches.

Mill production for Sipalay amounted to 113,224 dry metric tons of copper from which 3,104.71 dry metric tons of concentrates was produced with an average concentration of 23.87% copper or a production of 1,633,816 lb copper, the company reported.

During May the Sipalay division shipped 5,795.01 dry metric tons of ore containing 3,022,753.084 lb copper to Japan. Balance of concentrate stockpile after shipment was 1,368.36 tons.

The Taluntunan section of the project shipped 1,052 wet metric tons averaging 59.06% iron from the upper south Taluntunan open pit. Stripping in the area has been slower due to breakdown of equipment and heavy rains.

Big Gypsum Orebody To Be Opened In Mexico

U. S. GYPSUM Co. plans to spend some $5-million in a Mexican gypsum mining project. In what company geologists have termed the "largest gypsum deposits in the world by far," U.S. Gypsum will build two plant areas—one at the actual mining site and another at the end of a railroad at a shipping point on the Panuco River not far from the Gulf Coast city of Tampico.

U.S. Gypsum's Mexican company, Yeso Mexicano, S.A., will set up its operation halfway between the city of San Luis Potosi and the port of Tampico. The mining site is situated on a newly renovated mainline railroad for easy shipping to Tampico. U.S. Gypsum bought out the claims and tested property in some 35 of the various claims, blocking out an area that reportedly contains known reserves of 2-billion tons of commercial gypsum. The deposits were tested only to 100 ft but much of the area is known to have gypsum down to 500 ft.

Initially, U.S. Gypsum plans to ship 1,500 tpd from the site and will reportedly aim for yearly production of up to 1-million tons. The company will use its own self-loading 15,000-ton ships for quick turnaround trips to such ports as Houston, New Orleans, Mobile and possibly Jacksonville. Recently they have ordered 100-bottom-dump, 70-ton, gondola cars at about $15,000 apiece.

Mexican government officials reported they have declared the remainder of the discovery area a national reserve because they claim to have found bauxite deposits in the region. The Mexican government expressed hope of working the bauxite deposits in the future.

Pounded over 200 times by air hammer . . . still not cut!

Even after steady pounding with an air hammer, which delivered 80 pounds of pressure to the chisel edge, Gold Seal air hose was still intact! Think of how much you will save on costly replacements should your operator accidentally hammer Gold Seal for a few seconds . . . or a trucker dump a load of rock on it . . . or a tractor grinds over it.

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C. TUBE: Synthetic compound to insure maximum oil resistance. Won't soften or flake.

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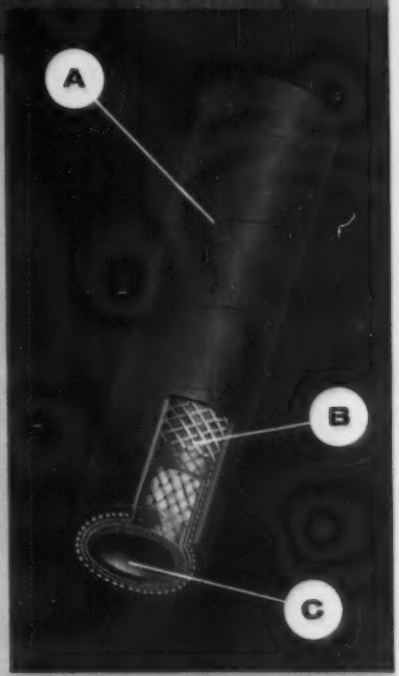

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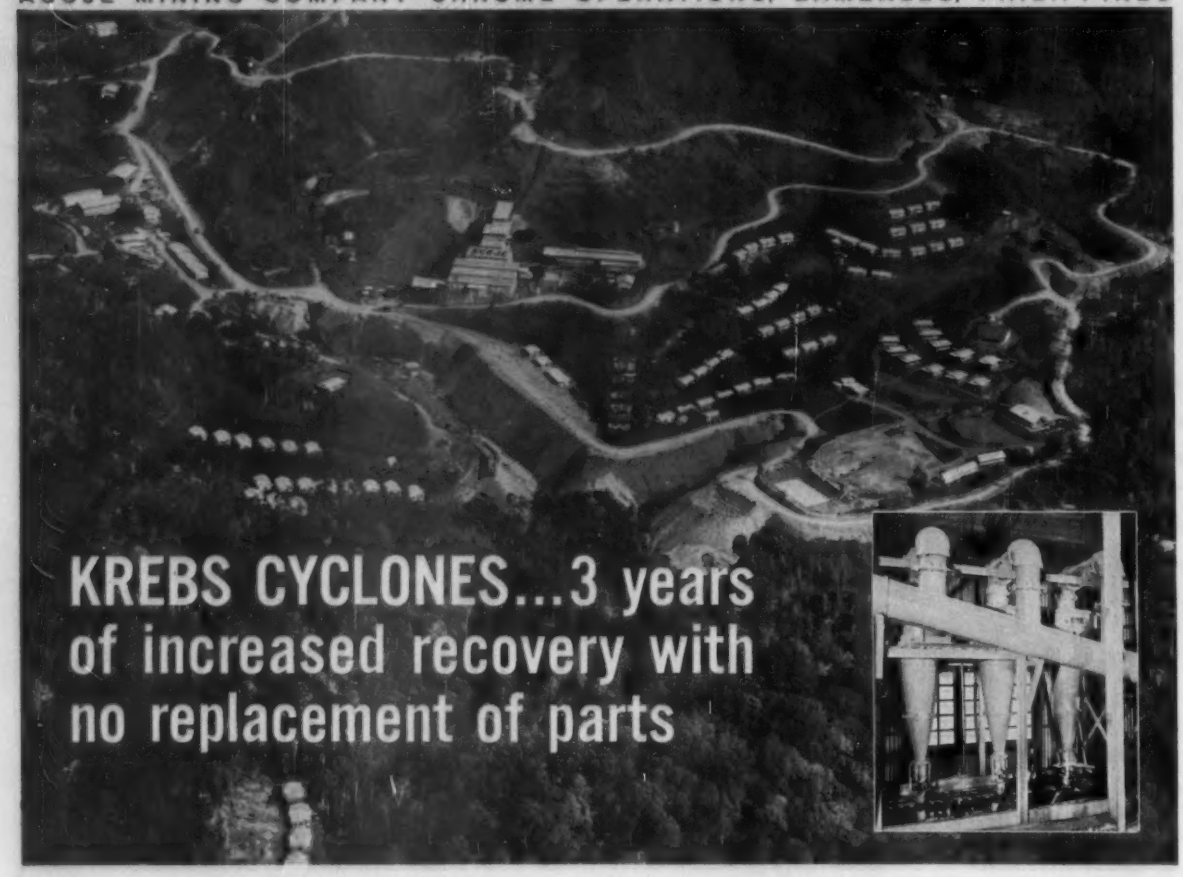

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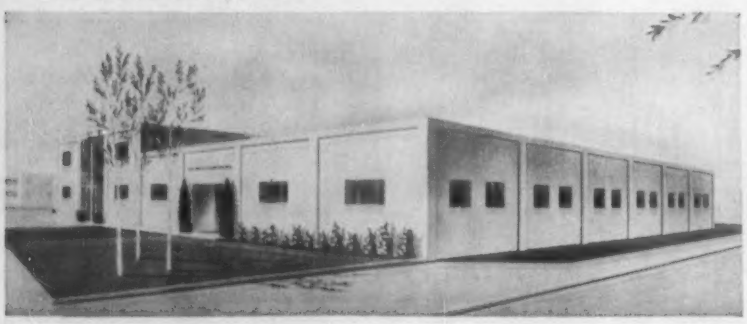
Installed in 1955 and paid for with savings in 3 weeks by increased recovery, Krebs Cyclones at Acoje have now operated for over 3 years with no replacement of Krebs Molded Rubber Liners. Scores of other operations have also made gains by the desliming and upgrading performance of Krebs Cyclones used ahead of tables, spirals, classifiers, thickeners, sizers and screens.

Equipment Engineers' Pilot Plant in Palo Alto, California, made full scale studies of Acoje samples prior to the installation and results were confirmed in the Acoje plant. Our Palo Alto facilities are being expanded that we may continue to serve the Mineral Industry more effectively.



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Cyprus Pyrite Production Falls From 1957 Figure

THE ISLAND OF CYPRUS produced 1,006,112 long tons of pyrites in 1958 compared with 1,080,081 long tons for 1957. A decline in output was reported by two of the three mining companies with a corresponding reduction in employment. Cyprus exported 228,821 tons valued at £1,446,000 in 1958 compared with 226,334 tons valued at £1,854,000 in 1957. (£1 Cyprus equals about US $2.80.)

Leading producer was Cyprus Mines Corp., which mined about 70% of the island's pyrites. Cyprus Mines cut production by 10% in 1958. Cyprus Sulphur & Copper Co., the only producer of cupreous pyrites, also reduced production from 68,000 long tons in 1957 to 55,084 in 1958. The third pyrite producer on the island, Hellenic Mining Co., increased production in 1958 to 323,544 long tons but announced that it was closing a mine and plant in 1959.

As a result of the steady decline in mining and the greater mechanization of the mines, employment has fallen. The decline in mining is blamed primarily on the elimination of marginal operations due to decreased world mineral prices. The government has helped with tax writeoffs for exploration and new plant investments.

Oil Firm Claims Break In Thorite Metallurgy

AN INDEPENDENT oil firm from Los Angeles, Calif., has claimed a "technological break through" predicated upon a 1-million-ton thorite deposit at Lemhi Pass, high on the Idaho-Montana border, and weak acid-precipitation metallurgy in a pilot plant established at the closed-down lead-zinc reduction center of Combined Metals Reduction Co., at Bauer, Utah.

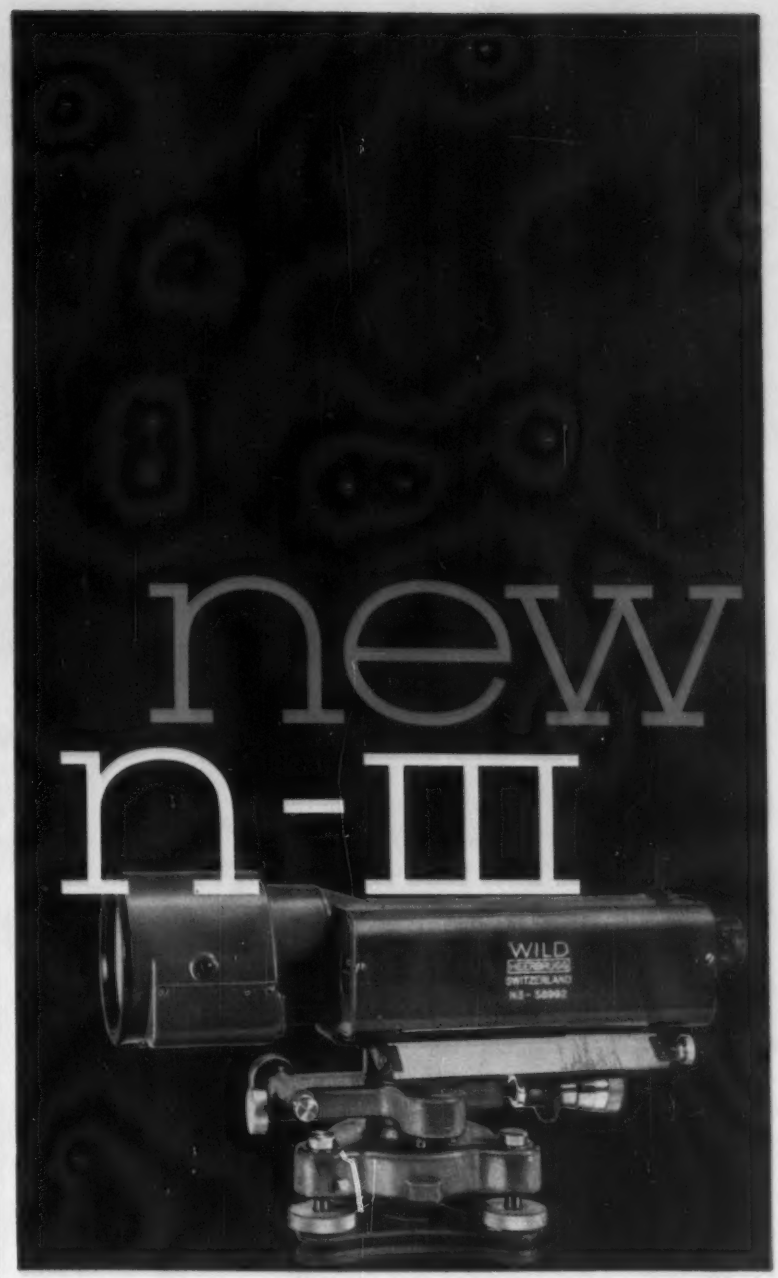
Flowsheet of the reduction process has not been made available.

However, Sawyer Petroleum Co., headed by E. W. Sawyer, Jr., of the Sawyer gold-mining family of Arizona, asserts the firm can produce 35% thorium concentrates as a result of process at Bauer.

Such values will enable Sawyer to compete with the domestic and foreign thorium produced from monazite available to the Free World he said. Extraction of thorium from monazite differs principally from that of thorite reduction in that the former process requires relatively expensive boiling sulphuric acid digestion.

Sawyer has shipped an initial batch of 35% thorium concentrate to Lindsay Chemical Co., a division of American Potash and Chemical Co.

E. W. Sawyer forecasts a market based on use by the Atomic Energy Commission, which is expanding development of thorium-U_{235} (breeder) high temperature reactors and the new uses predicted for thorium as an alloy with magnesium for application in supersonic aircraft development.



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All have tilting screw, coincidence level and built-in optical micrometer.

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Thorite *(Continued)*

A commercial unit at Bauer—there is consideration on leasing the mill itself—would involve production of a minimum of 600,000 lb annually of thorium concentrates.

The presence of undetermined amounts (in raw ore) of europium could add a plus factor to the Lemhi Pass deposit, E&MJ was told.

Volume production of thorium concentrates would pave way for recovery of the europium by either attendant precipitation or through later concentrate up-grading.

Lindsay produces a nitrate thorium salt. Others reduce the nitrate thorium compound to metal.

Europium has application as possible moderator in the development of nuclear propulsion units for rockets, it is reported.

Odlum Uranium Firms Plan Merger Into One

CREATION of one of the nation's largest uranium producing companies is moving toward completion. Substantial stockholder support has been received for the combining of Hidden Splendor Mining Co., wholly-owned affiliate of Atlas Corp.; Rio de Oro Uranium Mines, Inc.; Lisbon Uranium Corp.; Mountain Mesa Uranium Corp.; and Radium King Mines, all controlled by Atlas or subsidiaries with the exception of Radium King.

The new combine would be called Hidden Splendor Mining Co.

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IN THE U.S.

ALASKA

Donald Ross of Ketchikan has been flying his own aerial magnetometer (Sharpe A-3) for over a year, and has located several magnetic anomalies, not all of which he has had a chance to investigate. Paul Pieper has joined forces with Ross to do the ground work. Pieper recently ordered a self-potential geophysical outfit for use as an aid in picking up indications that the magnetometer or dip needle may miss. At least one other Ketchikan group is using an aerial magnetometer. Geochemical work is also carried on at times.

Ketchikan Community College is attempting to secure funds to enable it to hold a course in elementary geophysical prospecting. If funds are secured the course would be strictly for professional prospectors. The course would give prospectors a chance to compete on a level with the highly trained crews put in the field by mining companies, and would probably be two hours of instruction per week for 15 weeks.

Hyder Mines of Hyder, Alaska, at the Riverside property, is preparing a 100-ton smelter shipment scheduled for the Bunker Hill smelter at Kellog, Idaho reports Carl C. Wikstrom, superintendent of mines. The shipment is expected to average .4-oz gold, 20-oz silver, 1.3% copper and 35% lead. Mr. Wikstrom reports recovery about three tons of $60-mill ore for every ton of shipping ore. As soon as enough mill ore is stocked, he says, an 8-tpd pilot mill will be placed in production. Ore is at present being robbed from pillars left by previous owners. There are 2,000 tons available for the pillar operation, the recovery value of which will be used to expand working faces that show good values. An attempt is being made to block out enough ore to reactivate the 50-ton mill on the property.

The number of nonfloat plants (operations in which gravel is delivered to washing plants by bulldozer or draglines) rose during 1958 from 70 to 78. Despite the rise in number of active plants, yardage washed decreased 7%. Value of production dropped only 4%, indicating that nonfloat operated somewhat better grade ground. Nonfloat plants produced more than 18% of the gold output of Alaska. Production from hydraulic and small scale hand operations was negligible.

The number of active dredges rose from 21 to 23 during 1958. New York Alaska

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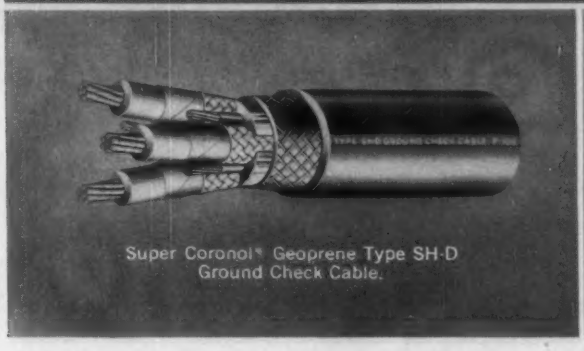

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Super Coronol Geoprene Type SH-D Ground Check Cable. The flexibility and sturdiness of this cable permit moving the load center forward without disconnecting the high-voltage power feeder. This cable, similar to standard Type SH-D, is available with an insulated ground check conductor in voltages up to 15 kv.

Super Coronol Geoprene Minepower Ground Check Cable. The non-metallic construction of G-E minepower cable provides light weight and ease of installation. The Super Coronol insulation on this cable—as on G-E Type SH-D cable—resists ozone, moisture, heat, and aging. The lead-cured neoprene jackets on both cables resist flame, oil, acids, alkalis, and sunlight.

These special-purpose cables meet various installation and application requirements. BOREHOLE CABLE • AERIAL CABLE • FLAMENOL* MINE TELEPHONE CABLE • SHOT-FIRING CORD • CORDX* LEAD-CURED TYPE SO CORD.

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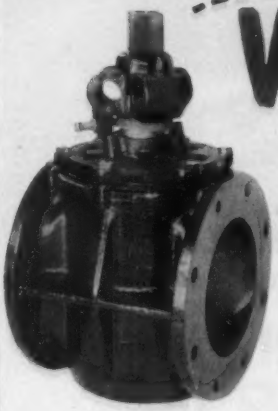
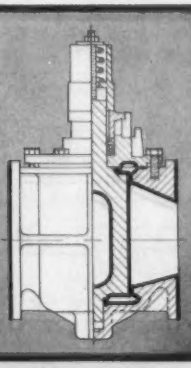


Process piping in the mining industry contains some of the roughest services a valve can be called upon to handle. Slurries with high concentrates of ore, acid solutions that will attack a valve and destroy it in a short time . . . these present one of the toughest problems an engineer can have. If your process piping presents problems like this, here's the long-term, low cost solution: DeZurik soft-rubber-lined Valves will last longer and deliver dead-tight shut-off at a lower cost than you'd think possible! Here's why:

All surfaces in the flow path are soft rubber lined, offering complete protection from abrasion and erosion. And the rubber lining is bonded to metal — there's no continual flexing, nothing to rupture! There are no internal cavities where slurry material can pack. And they'll close easily — every time — regardless of pressure inside the valve!



DeZurik Valves are available in sizes from ½" thru 20" with manual or remote operation. For more information, consult the DeZurik representative in your area, or write

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At Keystone Portland Cement Company's Bath, Pa., quarry, this Mack LVX takes on one of the fifty 22-ton loads it must haul each day to keep on schedule.

A 15% grade has to be tackled on the mile-long round trip from shovel to crusher. This Mack hustles up-grade with a full payload while its empty companion barrels back down to the shovel.

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Why not team up *your* big shovels with Mack trucks? They'll make fast hauls between quarry and crusher. They can be depended upon to meet scheduled tonnage requirements because Macks don't bog down or break down when the going gets rough . . . handle easily the heaviest loads under the most demanding conditions.

Whatever your requirements, your Mack branch or distributor has full details on the Mack off-highway dumper that will do the job better and more economically. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd., Toronto, Ont.

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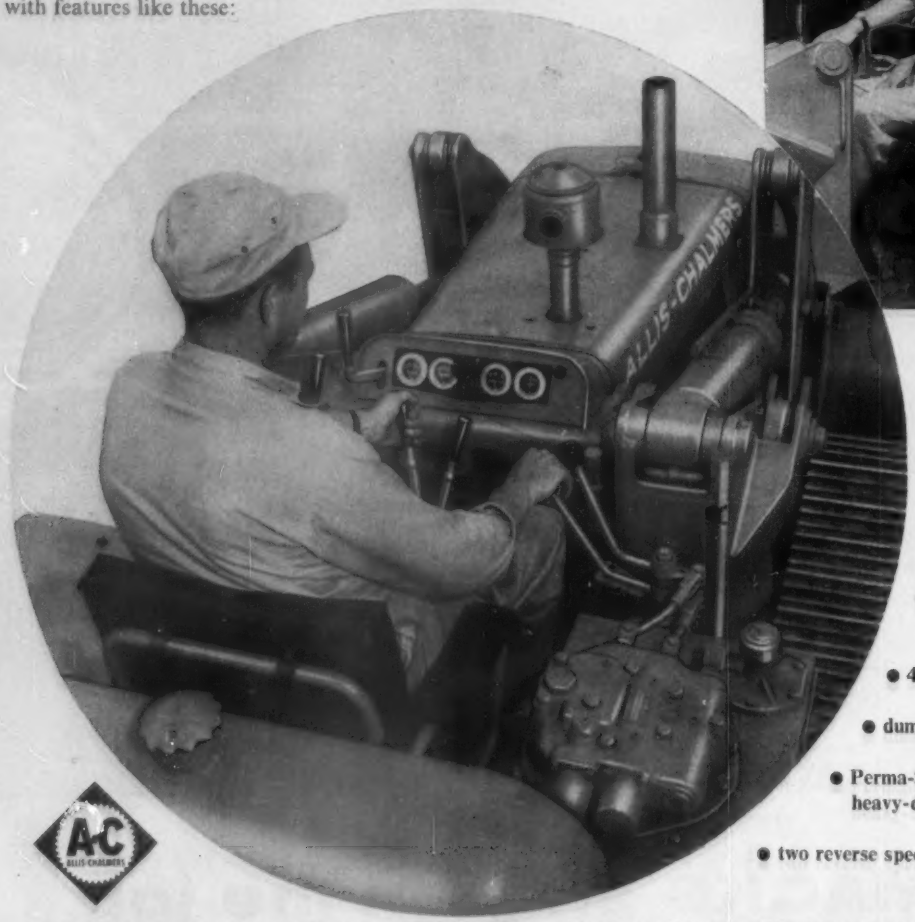
Back in 1947, Allis-Chalmers broke into the tractor shovel business—introduced industry's first successful hydraulically controlled unit. Today, we have its successor—the all-new HD-6G—a result of 12 years' practical experience. See for yourself if it isn't the best of the bunch with features like these:



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Alaska *(Continued)*

Gold Dredging Corp. added a third dredge to its operations in the Aniak district, Kuskokwin River region. Immachuk Mining Co. put a dredge into operation on the Inmachuk River, Fairhaven district, Seward Peninsula region. Dredges increased yardage dug by 12%, but value of output from dredging decreased 15%. Of total gold produced in Alaska in 1958, dredging accounted for 81%.

Value of gold produced in Alaska in 1958 was 13% less than the 1957 figure. Placer operations continued to supply almost all of the output (99%). Yardage of gravel washed increased 10% over that of 1957 but a decrease in grade of ground worked from 45c per yd in 1957 to 36c per yd in 1958 resulted in reduced yield.

It is reported that the Texas City tin smelter will be reactivated for the processing of tin. The statement was made in the course of hearings on S. 1957 which the Alaskan Senators and Senator Murray introduced. The bill would set a price and encourage the development and production of Alaskan tin deposits.

No tin has been mined in Alaska since 1955. The developments could reestablish tin mining in Alaska, since Alaska has the only significant tin resources in the U.S., it was reported.

COLORADO

There is more action by mining companies in the Gilpin-Clear Creek district. The record shows two or three up Virginia Canyon, some up Trail Creek, Gilson Gulch, Eureka Gulch, the Lucania with ten men working, the Big Five getting ready to haul ore to the Old Silver Spruce mill, now being operated by the Michigan Chemical Co.

Libson Valley Uranium Co. is on the John Smith property at Silver Plume, and it is reported that soon the old Lambertine mine back of the Freeland tunnel will be in the gold rush. The Humboldt Belgravia is being picked up for taxes and may soon be in partial operation.

John B. Rigg of Denver has resumed drilling and tunneling operations to evaluate the copper and gold-bearing vein structures at Summitville, including the famous Little Annie mine, which he has leased from the Reynolds-Morse Corp. and B. T. Poxson.

The DMEA program, instituted three years ago under the supervision of Dr. Richard V. Gains, has shown favorable continuation of previously mined ore shoots below the lowest old workings. Wallace Rogers of Golden is drill contractor.

The many buildings, stores, postoffice and 750 tpd cyanide mill show the effect of 17 years idleness and no doubt will be torn down soon. A new mill will be built if tonnages of sufficient amount are indicated. A new road to South Fork has given an all year route of only 17 miles to the railroad and vastly improved the economics of operation. In 1926 at Summitville, the Wiley-Pickens lease produced 690 tons of ore that averaged 35 oz gold to the ton. Even with gold at $20.00 an oz, this small high grade "pipe" of ore brought the men around $300,000.

A. O. Smith Corp. of Milwaukee, Wis., produced 100,000 tons of 0.50 oz gold ore from the hidden vein area of Summitville in an ore shoot 60 ft long and to a depth of 500 ft. Mining widths in veins over 40 ft wide are shown in this area.

Denver Golden Oil and Uranium Co. reports the Schwarzwalder mine near Golden continues to be one of the outstanding producers of uranium ore in the United States with a grade of product several times the national average. The company owns a 27% working interest in the property and is operator for the joint account of the owners.

"Diamond drilling has continued and new ore has been discovered on several of the levels. The grade of ore of the new discoveries in the mine continues high," says the report.

"Of the 18,260 tons of ore mined and broken during the year, 15,115 tons were sold and 3,145 tons were added to the broken ore accumulated in the mine stopes and in our stockpile at the Cotter Mill in Canon City. Average grade of ore sold during the year was .8024% U_3O_8."

At Loveland, Mount Olympus Mining Corp. has occupied new offices in the First National Bank Building. William Oestreich, president, said the firm is operating two open-pit properties producing mica, feldspar and beryllium. Demand for mica, Oestreich said, is concentrating the company's effort to increase production at the Poudre Canyon mica processing facility under a schedule to mill 80 tons of ore per shift. Along with mica, Poudre Canyon also produces high grade feldspar and a good trace of beryllium, Oestreich said. The other Olympus mine located near Estes Park south of Storm Mountain, is a beryllium producer primarily.

During the last six months, Standard Uranium moved to diversify further into base metals. W. R. McCormick, president, told shareholders in the interim report.

This included interests in the Shenandoah Dives Mining Co.'s holdings on the Sunnyside Mine in the Silverton District of southwestern Colorado.

Standard says there are 485,000 tons of $32-a-ton reserves of complex ores with gold, silver, lead, zinc and copper values already established at Sunnyside.

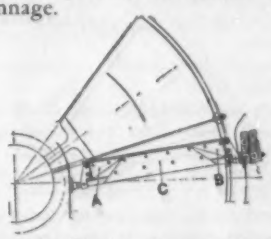
The Utah firm is developing tunnel access to the ore reserves. There are indications that the reserves are much greater than presently estimated, McCormick added. It will take about a year for the Sunnyside and related properties to be placed in operation, he said.

W. N. Monson of Silverton reports satisfactory progress being made on a mine access road which is being constructed

Complete Cake Discharge

with every revolution of the Disc!

After installation of the Peterson Contour Scraper*, the customer reports 30% more capacity and lower cake moisture. He says 100% of the cake discharges every revolution—no refiltering lumpy cake which has high moisture. Note the smooth, uniform cake on the first disc which is completely discharged every revolution, by the new Scraper. With Contour Scrapers on all discs, this customer expects one filter, instead of two, to handle his tonnage.



How the Contour Scraper Works:

The Contour Scraper is a three-section scraper, as shown above. Rubber blade is held by Plates A, B, C, which hinge independently of each other. As the bag inflates, the center section, plate C, contours out while sections A and B remain in place. Blade contours to the bellow. The action remains free, no freeze from sludge becauses all parts are sealed and lubricated.

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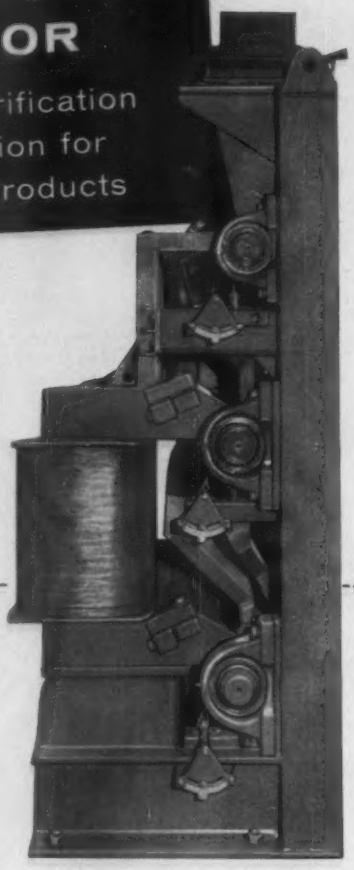
DINGS INDUCED ROLL SEPARATOR

High Intensity Purification and Concentration for Higher Quality Products

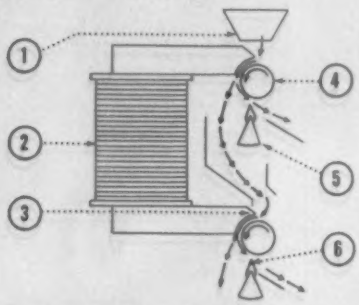


Here's the way to cut beneficiation costs and make greater profit with highest quality products. The newly improved design of Dings Induced Roll Separator permits highest capacities in separation of weakly magnetic materials. New pole nose contour attains tremendous magnetic intensity at separation zone. Adjustable knife-edge dividers assure extremely critical separation.

Result: In beneficiation of nearly every type of dry, granular material, you get higher quality product . . . in greater volume . . . at lower cost!

You Make More Money with these improved features

- New pole nose contour provides maximum intensity through 37.5 degrees of rotor arc
- Increased flux density from new magnetic circuit
- Magnet coil of anodized aluminum wire for longer life
- New vernier dial for accurate divider settings
- New slim-line frame design saves 52% of floor space
- Bearings are self-aligning, sealed, anti-friction type
- New feed distributor has no moving parts
- Efficient separation at capacities up to 800 lbs. per inch of rotor width per hour.



① Feed distributor ④ Laminated roll
② Magnet coil ⑤ Vernier dial
③ Magnet pole nose ⑥ Knife-edge divider

HERE'S HOW IT OPERATES

Material flows over the roll and through the smallest possible air gap between roll and pole nose. High intensity magnetic field lines passing through the air gap converge on the numerous edges of the laminated roll and deflect weakly magnetic particles in the direction the roll is turning. Nonmagnetic particles follow a normal trajectory. Adjustable divider cleanly separates magnetics and non-magnetics. Intensity of each roll can be altered to control the amount of magnetics removed. Dings IR Separators available with 1 to 7 rolls in 2" to 30" widths. Write for complete details.

DINGS MAGNETIC SEPARATOR COMPANY

4716 W. Electric Ave., Milwaukee 46, Wis.

Dings

Colorado *(Continued)*

to a point south and east of Clerk Lake. On completion, a tunnel will be driven 1200 ft to cut a series of gold-bearing quartz veins which were indicated by outcrops at surface last summer. If the ore goes down as indicated, it may be a good producer. This section of the district is known for its gold-bearing quartz as well as lead and silver ores.

Pinnacle Exploration Co. operates a uranium property in the Marshall Pass area on Indian Creek in Saguache county and reports it presently employs 40 men in the project. Most workmen live in Sargents.

Another rejuvenation of idle mining properties, near Ouray, became a reality when the Francis Mining & Milling Corp. commenced taking ores out of the old Torpedo Eclipse, Ruby Trust and Minnie "B" mines. W. C. Francis, president of the organization, said that it is anticipated that a minimum of 25 tons of gold, silver, lead and zinc ores will be processed daily; in addition to these, metallurgical grade fluorspar will be processed when the milling equipment is installed. Ore samples have been cut from the various drifts and are presently being analyzed.

Francis stated that negotiations are proceeding for the purchase and erection of milling equipment near the site of the Torpedo Eclipse portal. A flotation mill will be installed to process the ores from the 70 claims owned, leased or controlled by the corporation. The first of the new equipment—two truck loads—have arrived in Ouray.

The mines are located west above the Camp Bird Mine, in a once heavily mined area.

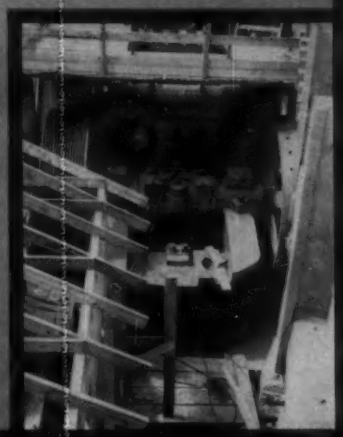
Russ Wood, general manager for Shenandoah Ltd. operations, states that construction is under way on two shop and warehouse buildings at the tunnel site in Gladstone. The buildings will be of prefabricated steel, mounted on concrete slabs. The contract was let to a Grand Junction firm.

Wood said the old Gold King tunnel was much larger at the portal than first anticipated. On inspection it was found to be 9 to 10 ft wide by 11 ft back. This will reduce the cost of slabbing and tend to speed the work. Whether or not this size tunnel was driven to the breast is not yet known.

Cresson Consolidated Gold Mining and Milling Co. at Cripple Creek, shut down temporarily on Sept. 1, according to announcement by Max Bowen, vice president. Bowen said the decision was forced upon the management by the continuing depressed condition of the gold mining industry.

Bowen said lessees and other employees will be given the opportunity of employment at the Ajax, the company's biggest producer in the District.

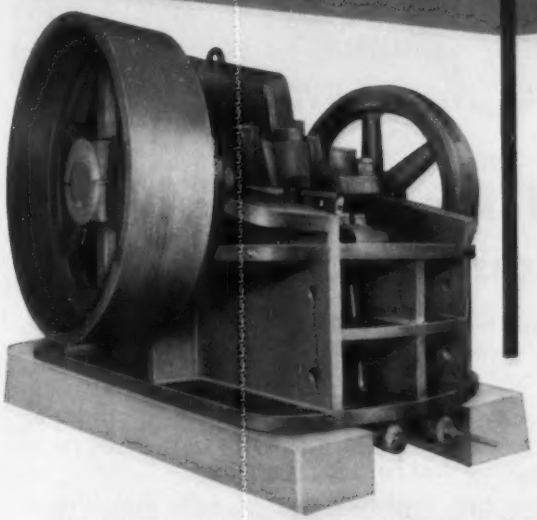
Company manager Charles Carlton said that the company will open up the Vindicator Lateral from the Ajax and launch a diamond drilling program as well as start a drive. Carlton also said there will be several leases available on



Traylor-made Type HB Jaw Crushers offer efficiency and economy

Shown above is a Traylor-made 48" x 60" Type HB Jaw Crusher in a stone crushing plant.

A Traylor-made 36" x 42" Type HB Jaw Crusher in a cement plant.



Many operators throughout the world experience daily the economy and rugged dependability of Traylor-made HB Jaw Crushers. Jaw plates are the famous curved type—the pitman shaft is made of annealed open hearth forged steel, light but of great strength. The swing jaw is made of cast steel of extra-heavy box section design to secure maximum strength. These are a few features of the Traylor HB Jaw Crusher. For additional information, write for bulletin No. 5105 today!

Traylor

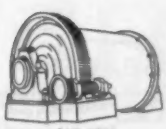
TRAYLOR ENGINEERING & MFG. CO.

1201 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

See the Traylor display at the Chem Show, Booth No. 495 New York Coliseum Nov. 30-Dec. 4



BALL MILLS

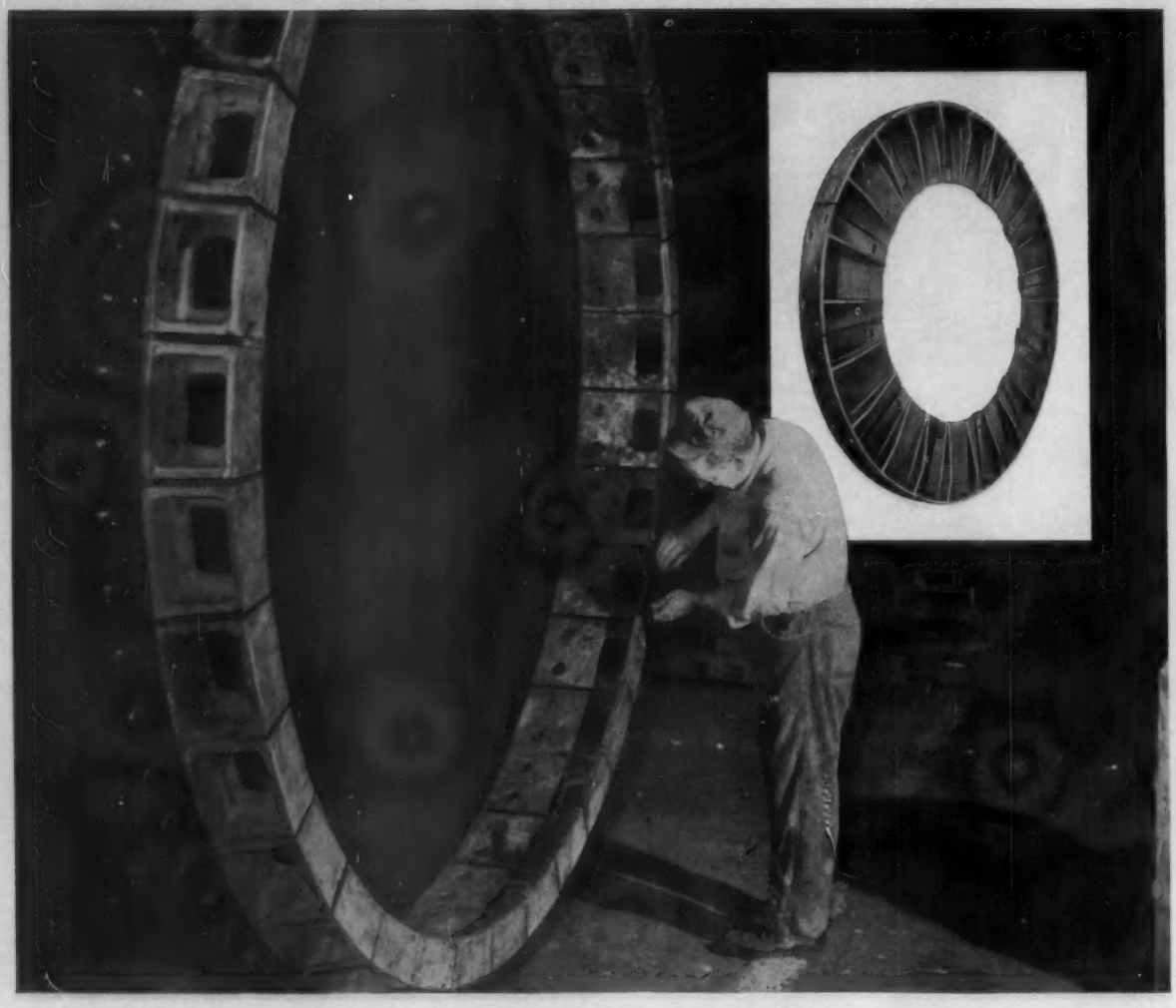
ROTARY KILNS

APRON FEEDERS

PRIMARY GYRATORY CRUSHERS

JAW CRUSHERS

SECONDARY GYRATORY CRUSHERS



IN CEMENT, LIME, AND DOLOMITE PLANTS...

B&W Nose and Tail-Ring Castings Demonstrate Longer Continuous Service

Longer brick life and longer continuous service are being attained by 275 kilns in 54 plants using B&W Nose and Tail-Ring Castings. In many cases, the life of these castings has exceeded 9 years.

Light and strong B&W Alloy Castings have improved kiln performance in most installations. Made of heat-resisting Grade HH alloy, nose ring castings eliminate belling out of the kiln shell, assuring longer brick life and longer continuous operation of the kiln. By protecting the end of the kiln shell from direct flame, the nose ring castings prevent "feathering-down" of the shell because of oxidation. Their design eliminates cracking and warping, experienced with large size castings.

Small size and light weight make B&W Castings easy and inexpensive to install. The protecting flange on the nose ring castings permits the use of low-alloy steel bolts for fastening.

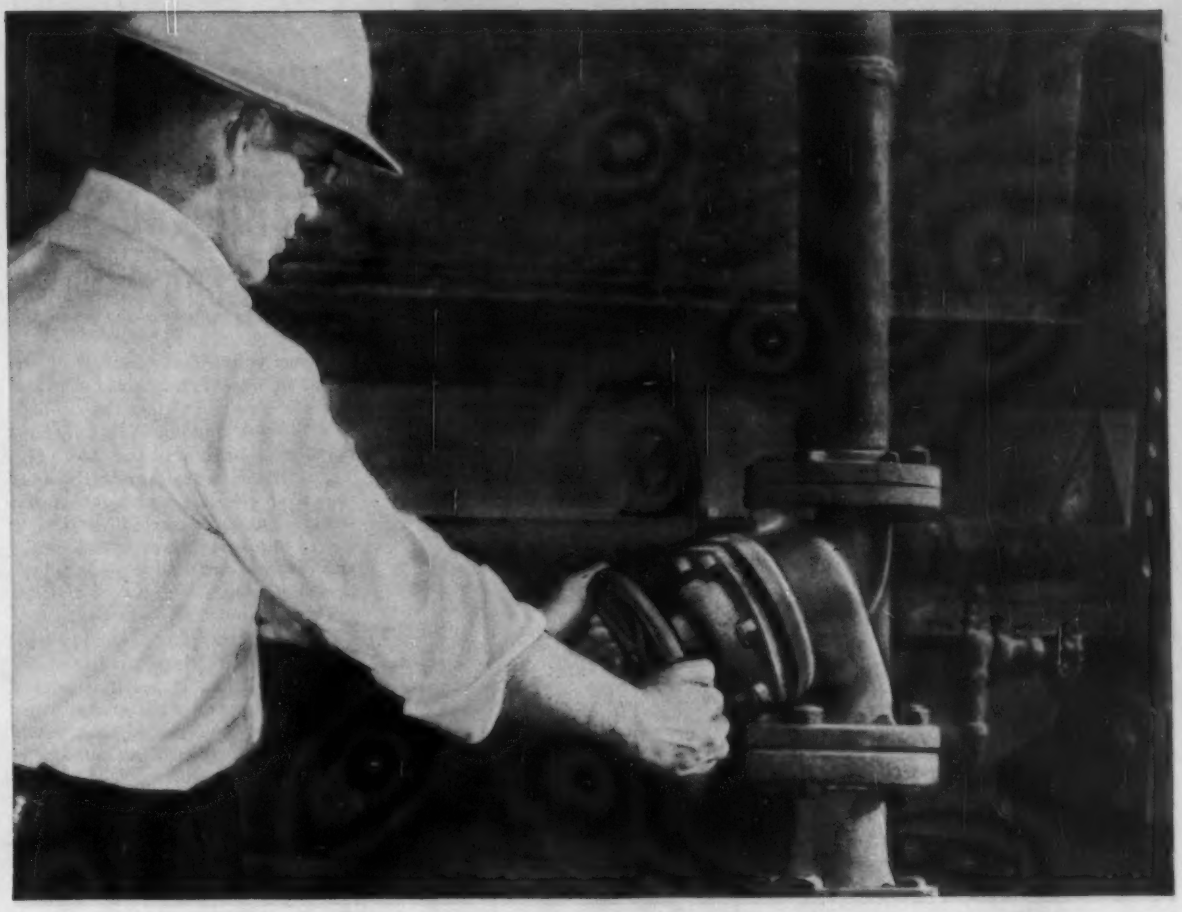
Spare part inventory may be kept low because the same nose ring castings may be used on kilns varying up to 4 feet in diameter, depending upon size. Write for Bulletin S-17. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

S-467



Power station licks "Ol' Man River" with Crane Diaphragm Valves

Raw Mississippi water that Union Electric Co.'s Venice Station, St. Louis, uses for ash sluicing was too tough for gate valves. Sand and sediment quickly chewed out the seating surfaces. Repair costs ran high.

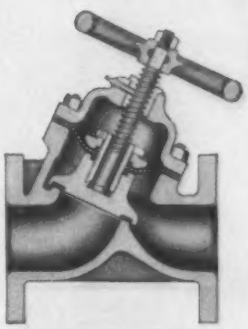
In 1951, the station started switching to Crane diaphragm valves. Ideal for slurry-type fluids, they beat the problem with their smooth, flow-through design and erosion-resistant seating. They haven't cost a penny's maintenance to date.

The resilient neoprene disc insert in these valves provides the most effective corrosion resistance. It makes a tight seat even on hard foreign particles. The diaphragm seals the bonnet completely—line fluids can't get into the working parts of the valve. Because the diaphragm is not used for seating, it is not subject to severe crushing or flexing and early rupture.

The same features that perform so well on river water save Union Electric many maintenance dollars on natural gas lines to boilers, and on compressed air and other water lines. They can do the same for you.

Write for free booklet

Get the complete story on Crane diaphragm valves. Ask your Crane Representative for Bulletin AD-1942 or write to the address below.

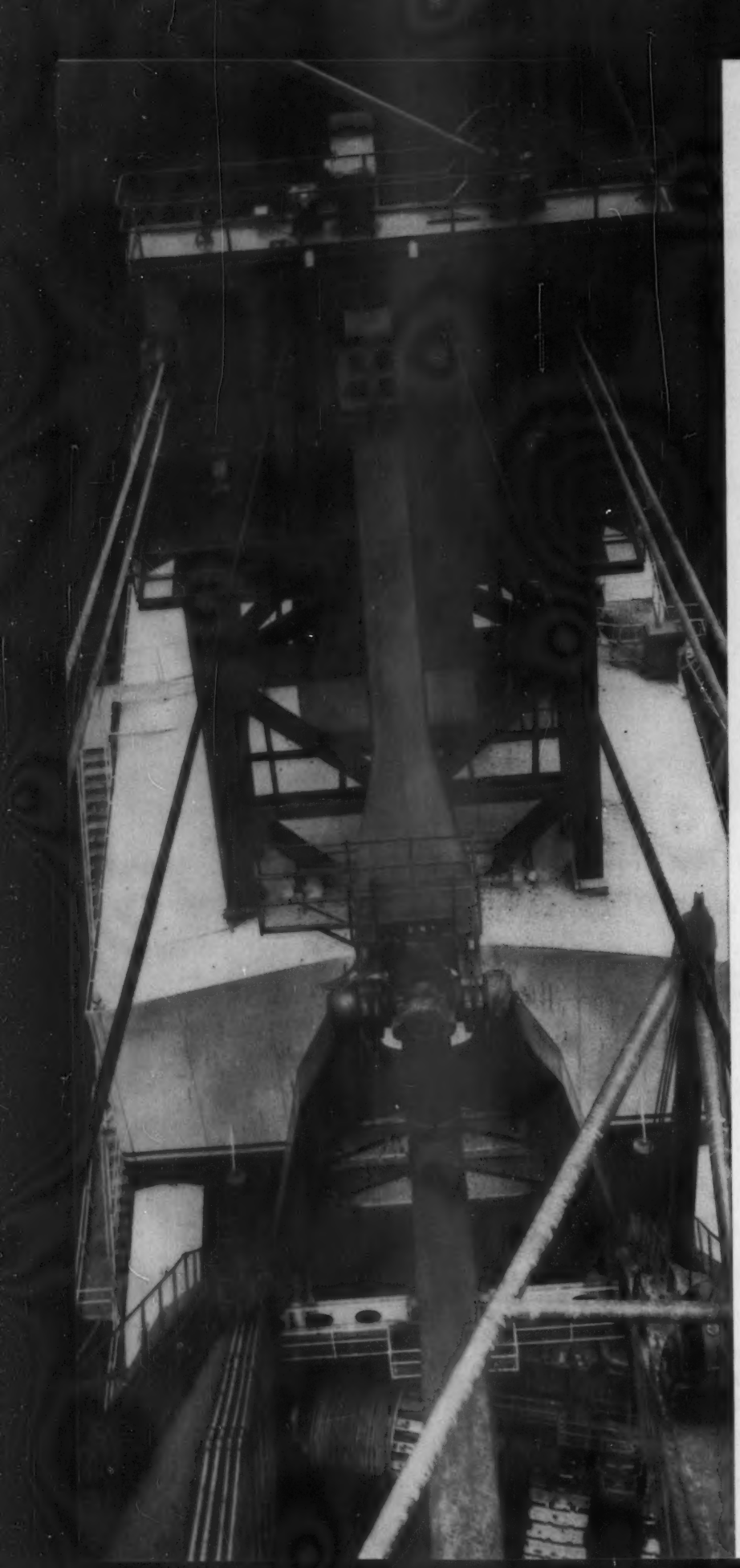


Note separate disc-diaphragm construction. Diaphragm serves only as bonnet seal while disc does the seating. Wide choice of body, trim and lining materials; Screwed or flanged ends.

CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Illinois—Branches and Wholesalers Serving All Area



Crow's nest view of USS Tiger Brand– America's No.1 Wire Rope

Imagine yourself at the top of the boom of one of the world's largest shovels. You're 147 feet up—as high as a 14-story building. The only supports you have are the four 3⅝" Tiger Brand Boom Support Strands shown at the left and right of the picture. But don't worry, these strands have a total strength of 3,072 tons . . . and they are designed to resist vibration and shock.

The two hoist ropes in the center lift a bucket that scoops up 100 tons of rock and dirt. These are 2⅝" diameter Tiger Brand Ropes that take a real pounding when the bucket rams into the rock and shale. They move about 60,000 yards of overburden in a regular 8-hour shift.

Most of the big shovels in use today are equipped with Tiger Brand Rope because it moves more tons of material at least cost for rope.

Why Tiger Brand is your best buy

1. It is made by a company that maintains the most complete research and manufacturing facilities in the steel industry.
2. It is designed by one of the country's most capable staffs of wire rope engineers. It is serviced by thoroughly experienced field representatives always ready with their assistance.
3. Every type of Tiger Brand Wire Rope is designed for specific applications. You get the *right* rope for the job.
4. It is made by one company, U.S. Steel, and every step of production, from ore to finished product, is carefully controlled and supervised to guarantee *one* high standard of quality.
5. Tiger Brand Wire Rope is manufactured by the foremost single wire rope producer in the country.

For more information, write American Steel & Wire, Dept. 9191, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks

American Steel & Wire Division of United States Steel

USS

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

Colorado *(Continued)*

the Ajax and it is expected that most of the Cresson employees will find work on either the Ajax or the Vindicator Lateral.

It is understood that Benson Mining & Leasing Co., of Tucson, Ariz. has recently acquired ownership of the Continental Chief Mine located in the northeastern head of the Iowa Gulch Amphitheater at Leadville.

Benson has indicated that it intends to have at least two sets of split-check leasers at work removing the ore left by previous operations. Furthermore, the additional sets of leasers can be utilized each 30 days thereafter as the property is "opened up."

The "split-check" method of operation is what is referred to when the ownership of the property being worked permits "independent contractors" to mine the ore available on the basis of the contractor supplying all labor, supplies, and operating expenses with the resulting income from the ore shipped split 50% to the owner of the property and 50% to the split check leaser (or independent contractor). This system was used by Resurrection Mining Co. for a number of years at the Resurrection No. 2 Shaft operation after profitable company operation was halted.

USBM is seeking contract for core drilling of between 1200 and 1500 ft in development of rhodonite reserves in the Silverton district of southwestern Colorado.

Drilling will be conducted at top of Placer Gulch at elevations of some 12,000 ft on properties of the Sunnyside mine. The mine is owned by United States Smelting, Refining and Mining Co., but is leased to an affiliate of Standard Uranium Corp., Moab.

Rhodonite is a gangue material in which lead-zinc values are found in the Silverton district.

The Intermountain Experiment Station of the USBM is conducting exhaustive metallurgical tests on reduction of rhodonite at Salt Lake Laboratory.

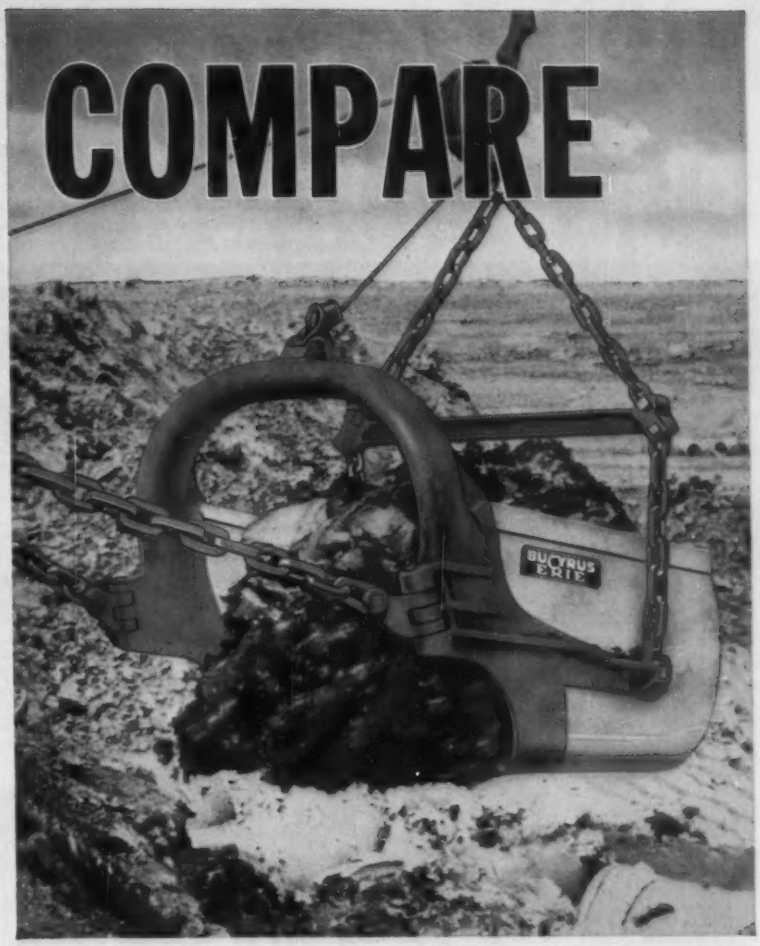
More than $22,000 was raised by the Uranium Institute of America in 60 days for the complete liquidation of its indebtedness.

In a letter to UIA members, Gordon Weller, executive vice president of the uranium industry association, said the organization was debt-free for the first time since its founding.

IDAHO

The Hercules Mine, the "poor man's dream" that became the source of half a dozen fortunes and built some of Spokane's biggest buildings was closed down Sept. 3.

The string ran out on the storied old property discovered at Burke in 1900 and developed by barbers, milkmen, bartenders, clerks, and students among others. It became a bonanza for those who stuck with it.



...and you'll buy BUCYRUS-ERIE

compare output Watch the "slicing action" lip take a faster bite, regardless of material . . . watch the tapered basket fill smooth and fast . . . watch it ride through the swing, smooth and even without bobbing and spilling . . . and watch the high-speed dump made possible by a clean inside design and high arch!

compare economy Ask others about long-life Bucyrus-Erie buckets! BECOLOY — a specially developed Bucyrus-Erie alloy — not only makes the buckets lighter, but adds great strength and wearing ability with higher impact resistance.

Your Bucyrus-Erie distributor will give you complete information on the complete line, all types, including solid and perforated; light, medium and heavy-duty. Call him today, or write Bucyrus-Erie Co., South Milwaukee, Wisconsin, Dept. 1RA.

BUCYRUS ERIE® Builds Better Equipment

Idaho *(Continued)*

Now, after yielding more than $80-million worth of lead, zinc and silver, it is being turned back to nature.

"We have mined out all the material that will make ore at present metal prices," said Rollin Farmin, mine manager for Day Mines, Inc.

"We are salvaging the equipment and the mine will be allowed to fill up with water.

Ace Sand and Gravel Co. at Dishman, (suburban Spokane) has been purchased by the Hecla Mining company of Wallace.

Purchase price was reported unofficially at more than $1-million. The purchase was announced by Lester J. Randall, Hecla president.

The company, incorporated in 1949, includes more than 40 acres of sand and gravel pits in the Spokane valley area, a crushing plant, a concrete mix plant, a fleet of trucks, garages and an office building.

ILLINOIS—KENTUCKY

Calvert City Chemical Co., in charge of Pennsalt's fluorspar mining and milling operation in Crittenden County, Ky., has started extension of its Dyer Hill mine shaft at Mexico from a 350-ft to a 470-ft level. Monty West, of Marion, Ky., is manager of the company's Mexico property.

Tamora Fluorspar Mining Co. nears completion of a new shaft on the Lee fluorspar property in Hardin County, Ill., east of Karber's Ridge, Wiley Cochran, president and general manager, has announced. The 110-ft level of the ultimate 150 ft has been reached.

Ozark-Mahoning Fluorspar Mining Co. has constructed an access roadway, erected a new headframe and completed preliminary work preparatory to sinking a new shaft on its Reed property in Pope County, Ill., according to Arthur G. Johnson, vice president and general manager. The shaft will be sunk to 275 ft.

MICHIGAN

The new Homer-Wauseca shaft of the M. A. Hanna Co. at Mineral Hills is one of but three or four mines in this country which has a Koepe hoist installed in its headframe. Its hoisting mechanism is fully automatic—the only one of this type in the U. S. The headframe, with green, corrugated, plastic windows, is 130 ft high. It has an elevator which carries passengers to the top floor—110 ft—where the Koepe hoist motors are located. Only 500 tons of ore had been hoisted when the strike halted operations. At the shaft's collar, to support the heavy headframe and its equipment, the walls of the 20 ft circular, concrete shaft are 12 ft thick. A 13-ton electric underground haulage locomotive was easily lowered into the mine on the cage just before the mine was closed. The two 14 ton capacity skips, moving at 1900 fpm, can bring up 800 tons of ore an hour, which is far beyond the productive capacity of the mines. The skip hoist drums are 12 ft 4 in in diameter, each powered by a 700 hp motor. One skip will handle ore from the Homer mine while the other will hoist Wauseca ore—a unique arrangement made necessary by different fee ownerships which require that ore from the two mines be kept entirely separate from each other. At the surface the ore drops onto a pan feeder which moves it to the proper belt conveyor. This will carry the ore from each mine to railroad cars or to its own storage area. The cage for lowering and hoisting the miners is double-decked, 13 ft 6 in. long and 6 ft 8 in. wide, the largest on the Menominee range. All the hoisting mechanism is equipped with safety devices in case of equipment failure.

Air is pumped into the mine at the rate of 150,000 cfm. In winter the air is warmed before being circulated underground.

Following a study of the mining industry of northern Michigan by a special legislative committee last year, two bills were passed by the legislature and signed by Gov. Williams. House Bill No. 586 authorizes the use of water for the operation of low grade iron ore concentration plants. House Bill No. 268 clarifies the law relating to the taxation of low grade iron ore properties.

Quincy Mining Co. is operating its copper smelter at Hancock, since July 1, and its dredge and tailings reclamation plant at Mason. By finer crushing of the old tailings and by use of the flotation process, about 6 lb of copper are recovered from one ton of tailings.

MINNESOTA

Pickands, Mather & Co.'s Tioga No. 2 mine is located west of Grand Rapids, almost directly south of Cohasset and between two branches of Pokegama Lake, the farthest west active Mesabi range mine. Most of the mine's ore is not amenable to the simple washing process and requires treatment by the sink-float method (using ferrosilicon) and by cyclones, using magnetite. Since both ferrosilicon and magnetite are expensive, as much as possible is recovered for re-use. The coarse and fines of both types of concentration are shipped separately for more advantageous handling at the furnaces. Fee of the property is owned by the state of Minnesota. After shipment of 674,488 tons in 1958, an estimated 1,656,510 tons remained in

THE CONCENTRATION PLANT is currently under test at the Cuban nickel operations of Freeport Nickel Co. The auxiliary units—sulphuric acid, hydrogen and hydrogen sulphide plants—which will supply the process, are now on standby.

Freeport Nickel's Moa Bay Starts Mining

MINING OPERATIONS are under way at Freeport Nickel Co.'s nickel-cobalt project at Moa Bay, Cuba, which will process 5,500 tpd of ore to produce 125 tpd of nickel-cobalt concentrate following start-up later this year.

Mining of the limonite ore has begun and the concentrator is now undergoing testing. Ore will be mined by dragline, loaded on trucks, put through log washers, and sent to the plant in a 25% slurry.

Acid leaching will extract the nickel, cobalt and other minor metals, leaving iron ore as a residue. Processing continues through a raw liquor to a "product" liquor which is autoclaved and the nickel and cobalt precipitated. The concentrate is then shipped to Port Nickel, La. for refining.

From the time the ore enters the slurry at the mine, it is in a continuous pipeline at varying density as it passes through the process, into a tanker at the port in Cuba, across the Gulf and to the refinery at Port Nickel.

Announcing WORLD'S TOUGHEST OFF-ROAD TIRE!

All-New Nylon U. S. Royal Super Con-Trak-Tor with ...69% to 95% Longer Tire Life!

S.R.T.*

Steel Reinforced Tread*

New S.R.T.—as shown here in the X-Ray photo—is a **tough** reinforcement of tread, shoulder and buttress areas. It consists of several thick layers of tread rubber containing thousands of short lengths of brass-coated steel filaments. This forms a virtually **impenetrable** mat between the tread and nylon cord body and extends down through the shoulder and buttress areas providing **positive** protection against combination cut-and-impact failures!

Add to exclusive Steel Reinforced Tread... 50% deeper tread at center... far deeper tread at shoulder... 25% more ground contact... Double-Strength Nylon and you have the world's **toughest** off-road tire! No wonder the great new U. S. Royal Super Con-Trak-Tor-S.R.T. outperformed **every** tire put against it—by the widest of margins—up to 95%! Can you afford less on **your** jobs?

U.S. ROYAL SAFETY 1st TRUCK TIRES

US RUBBER **United States Rubber**

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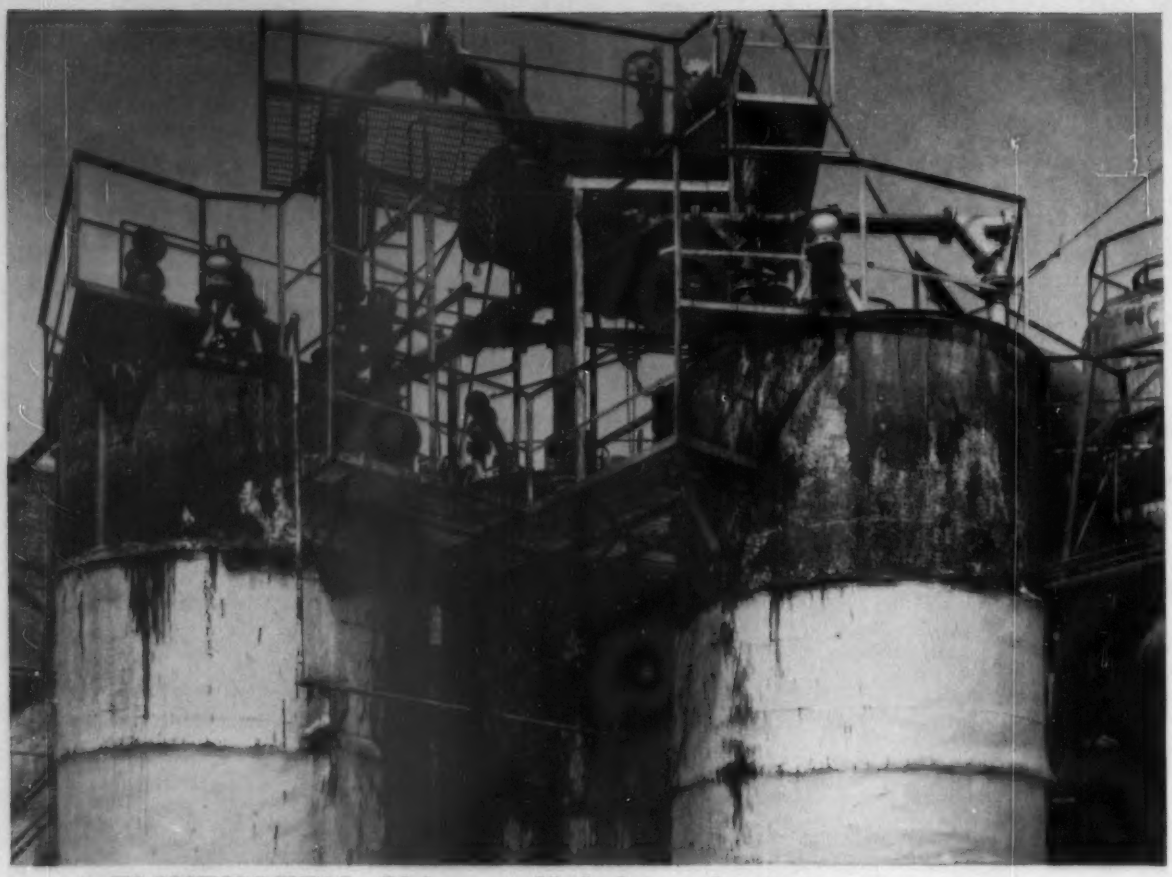

at FLINTKOTE'S Chicago Heights plant:

13 years continuous operation prove advantages of TURBO asphalt oxidizers

Thirteen years ago three General American TURBO asphalt oxidizers were installed at Flintkote Company's Chicago Heights plant. The units were piped to operate either individually as batch oxidizers for special products or in series for asphalt blowing. They require less than 15 hp each, and each is capable of handling up to 1000 cfm of air. They afford a rise in the melting point of asphalting material, varying from 12 to 20 degrees per hour, depending on the type of flux being produced.

For thirteen years the units have been in continuous operation, providing advantages of low power consumption, high air efficiency and accurate control of product specification.

The Flintkote installation is typical of TURBO asphalting equipment installed during a 25 year period to give higher production rates per still, lower power costs and less down time. TURBO units are safer to operate, need less top steam and less firing because of greater heat generation in the asphalt.

Ask for a TURBO engineer to discuss application of TURBO equipment to your needs.

FOR DETAILED INFORMATION AND USEFUL DESIGN DATA, SEND FOR THE FOLLOWING BULLETINS:

Please send me the following Turbo-Mixer Bulletin (s):

General Turbo-Mixer Bulletin_____

RDC Extraction Column Bulletin_____

Process Equipment Division

TURBO-MIXERS

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street

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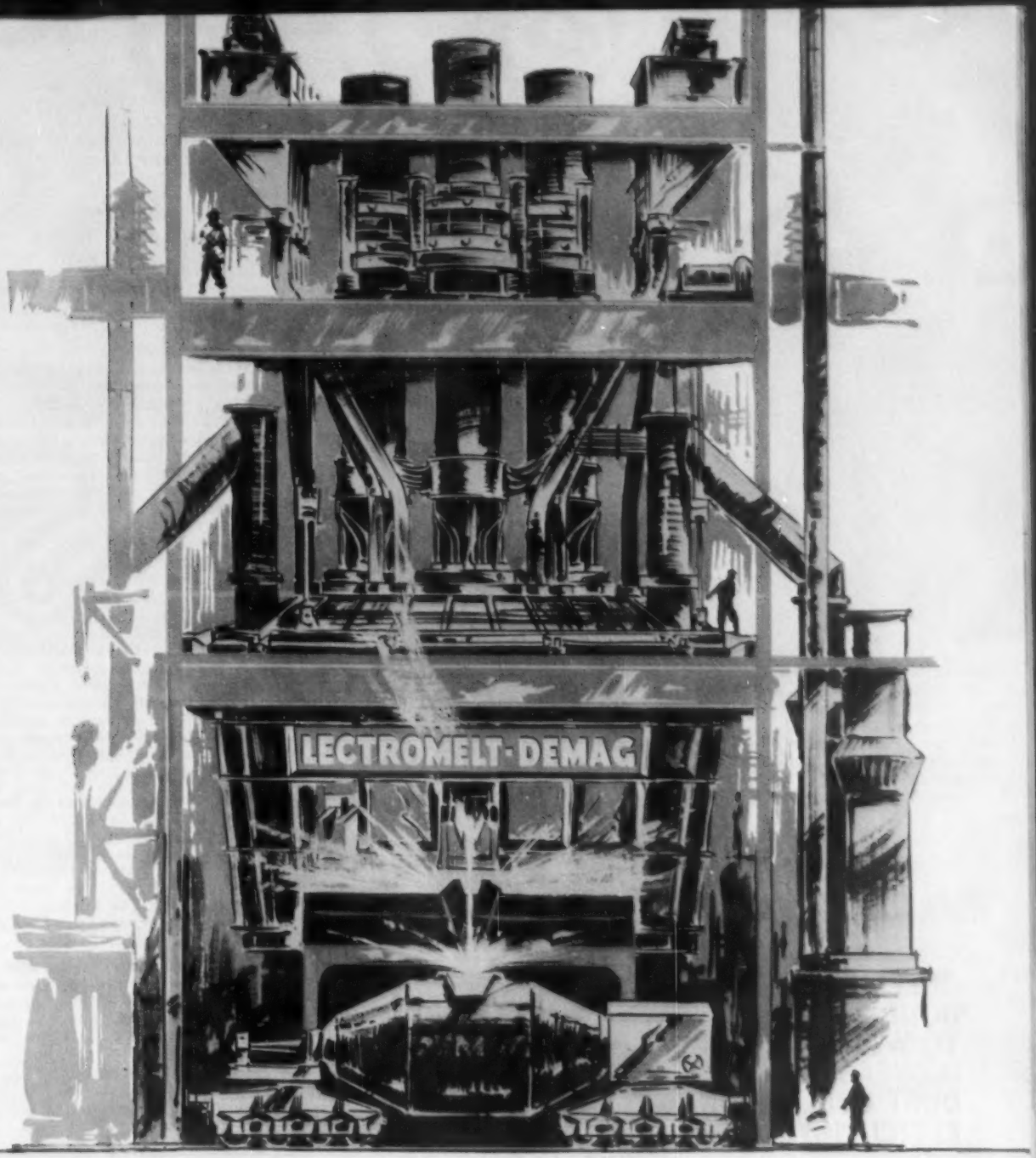


New highs in efficiency, economy and safety with LECTROMELT-DEMAG electric smelting furnaces

The advanced design of the Lectromelt-Demag smelting furnaces assures you of the highest electrical and thermal efficiency. For example, electrical losses in the electrodes are minimized by low-level electrode clamps. Hydraulic compression of contact clamps provides uniform pressure, preventing distortion.

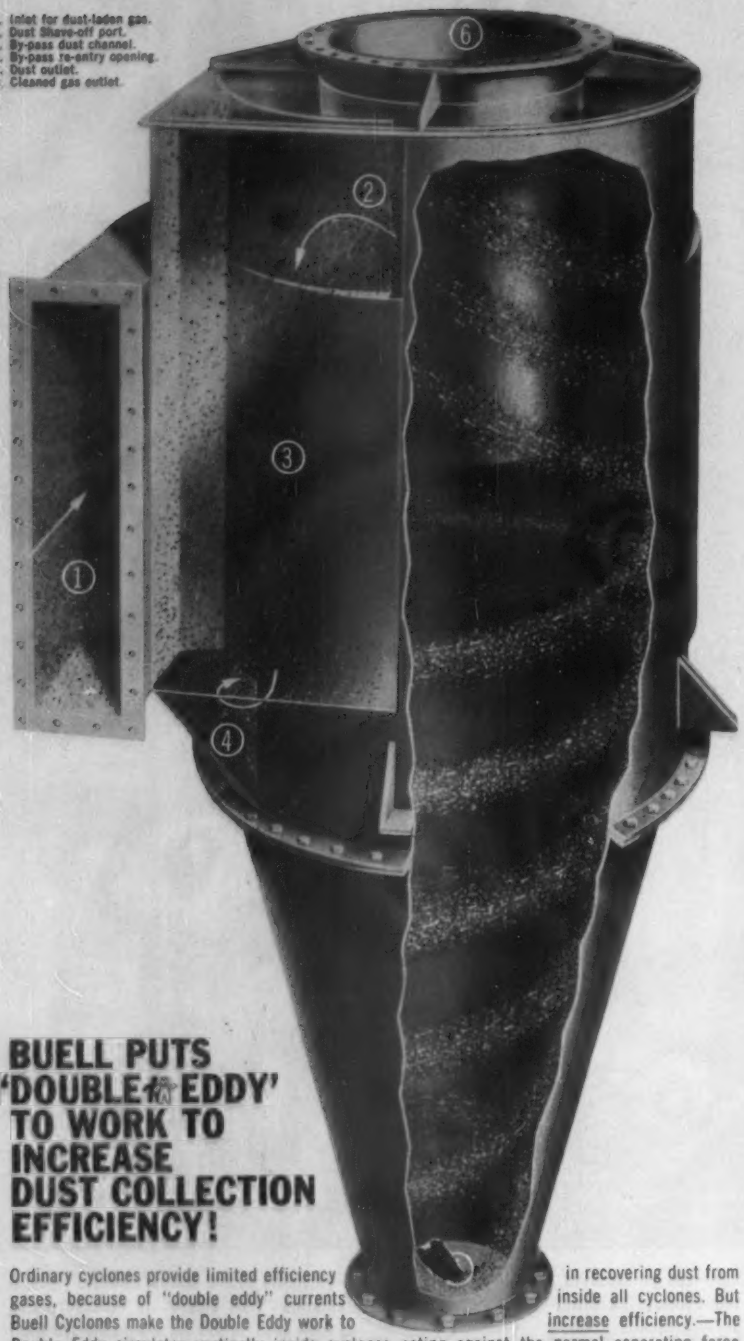
Ease of operation gets similar attention. All operations are planned for handling by semi-skilled operators. Furnace controls are mainly mechanical or automatic, with provision for remote control.

To this efficient Demag design, Lectromelt brings its experience in engineering and quality workmanship. The result is unmatched economy and dependability in all smelting applications.

For help in adapting electric furnaces to your requirements, contact Lectromelt Furnace Division, McGraw-Edison Company, 322 32nd Street, Pittsburgh 30, Pa.

FOR THE MOST EFFICIENT MELTING **Lectromelt®**

McGRAW EDISON


1. Inlet for dust-laden gas.
2. Dust Shave-off port.
3. By-pass dust channel.
4. By-pass re-entry opening.
5. Dust outlet.
6. Cleaned gas outlet.

BUELL PUTS 'DOUBLE EDDY' TO WORK TO INCREASE DUST COLLECTION EFFICIENCY!

Ordinary cyclones provide limited efficiency in recovering dust from gases, because of "double eddy" currents inside all cyclones. But Buell Cyclones make the Double Eddy work to increase efficiency.—The Double Eddy circulates vertically inside cyclones acting against the normal separating force of the spinning stream of dust and gas. Buell Cyclones have a narrow "Shave-off" port (2) at the top of the casing. This port catches and removes dust trapped in the Double Eddy. It makes the cyclone more efficient instead of less.—This is one of the reasons eight out of ten Buell installations pay for themselves in five years or less.—Only Buell Cyclones combine this efficiency with large diameter. They will not clog or plug even with dust loadings up to one pound per cubic foot of gas. No field fitting is needed: they are completely assembled and match-marked before shipment. They can be completely lined, inside and out, against heat, corrosion and abrasion.—For a list of installations near you, a copy of our Catalog 103, or other information, call our nearest representative, listed in the telephone classified directories of most major cities under "Dust Collection Systems". Or write Dept. 19-J, Buell Engineering Company, Inc., 123 William Street, New York 38, New York. (European Subsidiary: Ambuco Limited, London, England.)

EXPERTS AT DELIVERING EXTRA EFFICIENCY IN DUST RECOVERY SYSTEMS: CYCLONES—"SF" ELECTRIC PRECIPITATORS—COMBINATION SYSTEMS—DRY CLASSIFICATION SYSTEMS.

buell®

Minnesota *(Continued)*

the mine at the beginning of the 1959 season. Estimated tonnages are arrived at by engineers of the State Tax Commission and the operators and, usually, are reasonably conservative.

The geological staff of the W. S. Moore Co., Duluth, consisting of Jack V. Everett, chief geologist, Robert Werner, geological engineer and John Ontman, geologist, is spending the summer in Quebec-Labrador on exploration work.

Great Northern Ry. and the University of North Dakota have signed a two year contract under which the University will carry on a research project designed to develop a process by which the low grade lignite coal deposits of North Dakota may be utilized to create a commercial product from Minnesota's non-magnetic taconite. This will supplement and enlarge upon a five year agreement made in 1956 with the universities of Minnesota and North Dakota. The University of Minnesota has been working on a non-magnetic process and has made encouraging progress. The Great Northern and the Univ. of North Dakota have jointly announced that Great Northern has provided a certain sum of money for the project which would bring North Dakota's great deposits of lignite coal into the picture with Minnesota's immense amounts of non-magnetic taconite. The Great Northern is interested as a potential carrier of both the coal and taconite.

Two ore boats were loaded at the Great Northern Ry. docks in late August: the J. F. Durston on August 25 with non-union mine ore from Stanford, Mont.; and the Berwind (M. A. Hanna) with ore on hand at the docks when the strike was called. The Durston carried 7,320 tons and the Berwind 13,800 tons, on Aug. 27.

The U. S. Bureau of Mines, after a thorough investigation of the Sherwood mine disaster, which occurred on June 1, (see E&MJ, July 1959) has included five recommendations in its 36 page report.

(1) A positive procedure should be established to insure that each mined-out stope will be back filled immediately on completion.

(2) Back fill material should be of suitable porosity to allow drainage.

(3) Fire areas in abandoned stopes should be sealed with substantial bulkheads, and pipes for sampling the atmosphere behind the bulkheads should be installed.

(4) Fire seals should be patrolled at regular intervals; temperature readings and air samples should be taken and recorded. These records should be open for inspection by authorized persons.

(5) Consideration should be given to scheduling regular meetings between company officials operating mines with common property lines for an exchange of pertinent information regarding mining activities near the line.

"A copy of the report was also sent to Iron county mine inspector, Reino Anderson. Although the report was

Alemite Loader Pump is 3¼ Man-Hours Faster than hand loading, for every 100 lbs. of grease used! Insures delivery of clean grease, free of dust and grit that can cause costly breakdown. Just a few strokes fill gun. Models to fit and seal any original container—from a 400-lb. drum to a 25-lb. pail. No mess—no waste!

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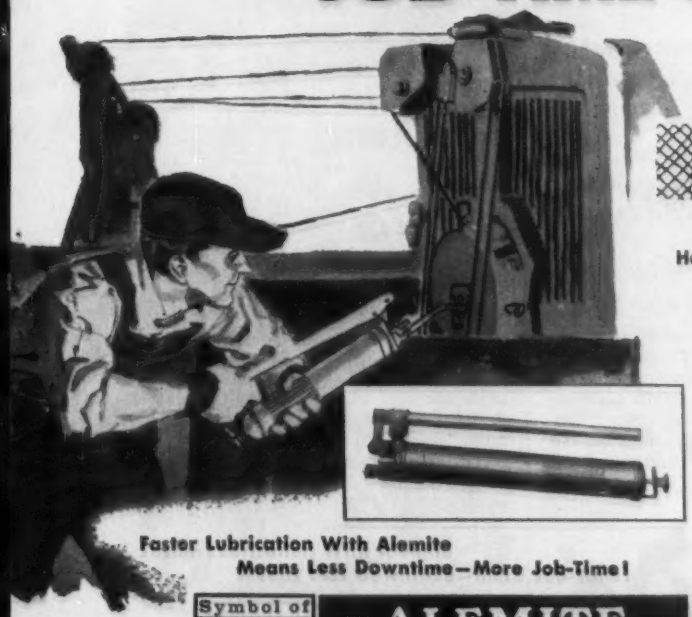

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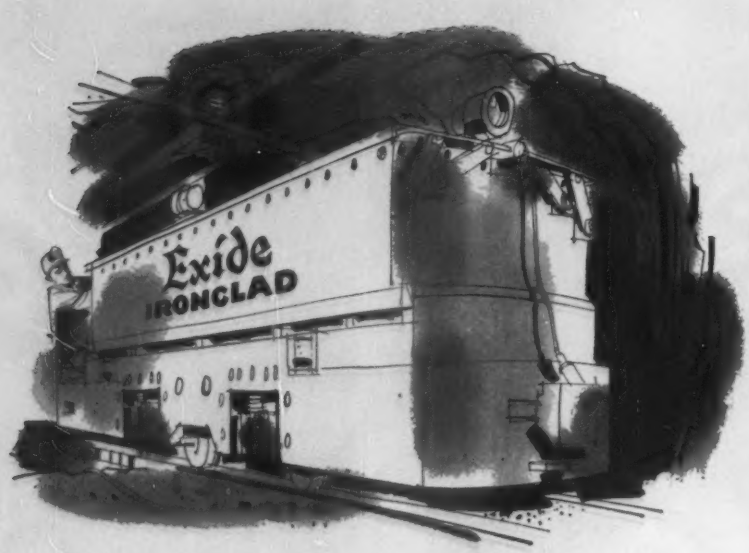

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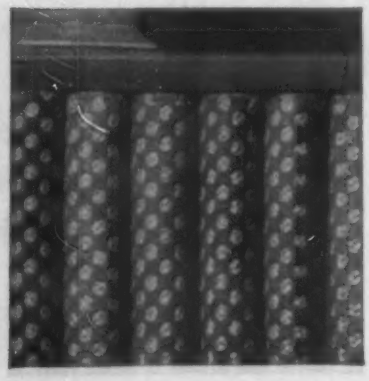

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Minnesota *(Continued)*

made out by the Bureau of Mines, it was based on independent investigations conducted by the Bureau, by mine inspector Anderson, by the Michigan Department of Health's Division of Occupational Health, a special investigating committee appointed by Gov. Williams and officials of Inland Steel Co. The report gives its explanation of the cause:

"(1) Spontaneous combustion of black slates in the mined out area—had resulted in the formation of a mass of highly heated material.

(2) Water, probably surface runoff into the subsidence area, had entered into the fill material and collected some point above the heated material. (This is purely conjectural)

(3) There is a partial collapse of the weakened floor pillar over No. 1406 north stope."

Conclusions 4 and 5 follow this up and conclusion 6 states: "Most of the resulting hot gases and steam vented out on the 1200 ft level west drift and reached the shaft through the main drift." The reports says that no evidence of flame was found in the mine and that the force created by the blast was not of high velocity.

The Iron Range Resources and Rehabilitation Commission, moved a drill onto Oliver Iron Mining Division property near Eveleth, and prepared to drill. President R. T. Elstad of the Oliver reported that the Commission had moved in the drill "without even the courtesy of prior notification" and had cut down trees and cut a half mile long roadway to get the drill in. He said this was "trespass" and challenged the use of I.R.R. funds for test drilling. Oliver ordered the drill moved a way. Gov. Freeman has directed Attorney General Miles Lord, to begin an action at once to obtain court authority for drill tests on private property to determine whether or not the particular land concerned is properly classified for taxes. Information presently available to the state comes from such drill tests as the owner may conduct.

MONTANA

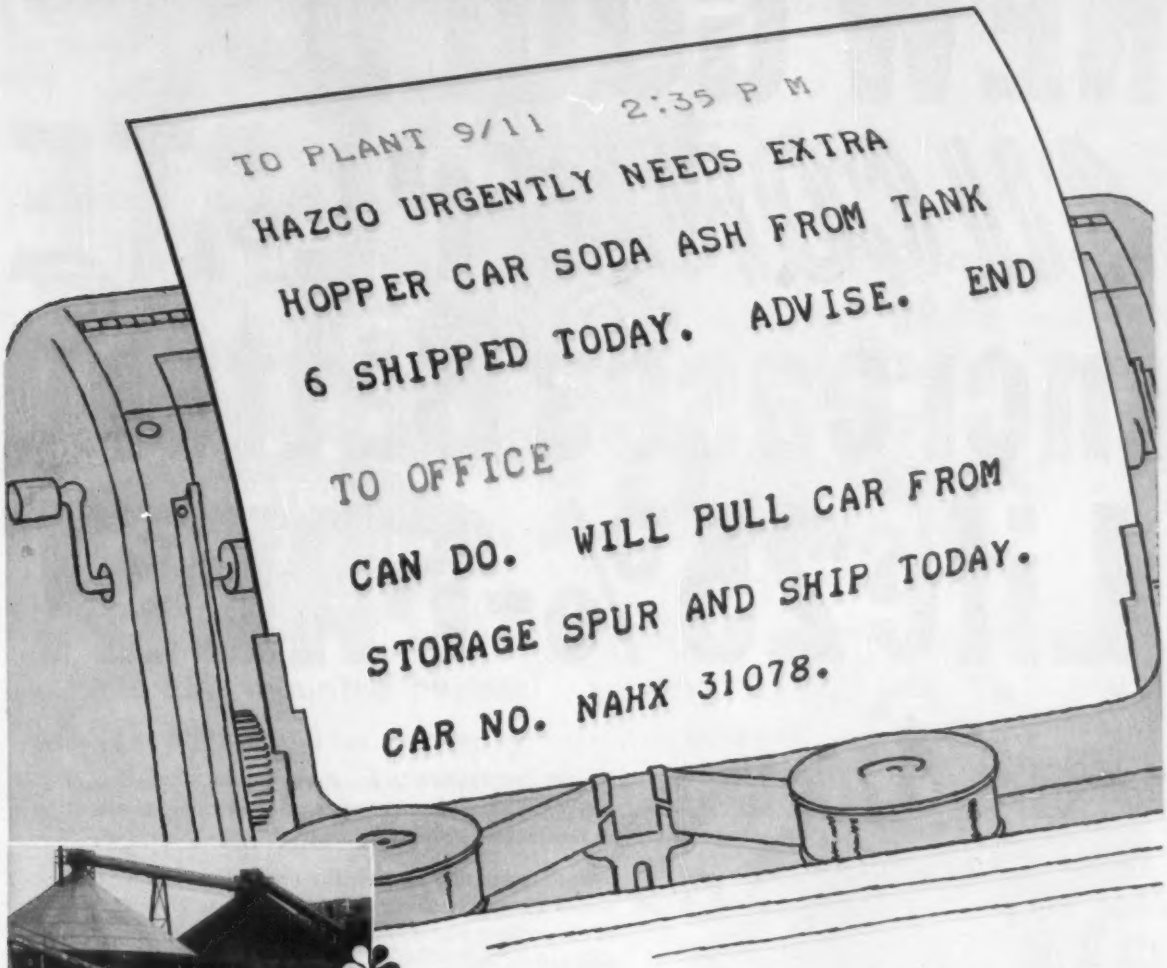
The 60-year-old Yogo Sapphire Mine near Utica, is producing about $6,000 worth of gems daily, Thomas P. Sidwell, a director of the New Mine Sapphire Syndicate said.

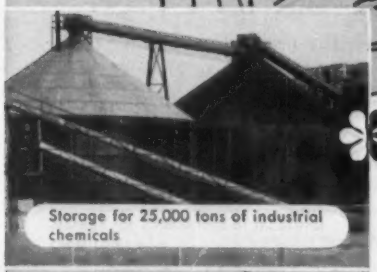
This estimate, he noted, does not include the cost of cutting and recovery. A five-man crew presently works the mine, producing about 3,000 carats of sapphires a day, Sidwell said. Plans are to extract 100,000 carats before summer's end.

Gem-quality sapphires are sent to Siam, Germany, Switzerland, France and England for cutting, he indicated. Their biggest market has been in Europe, mainly because of the American custom of buying diamond wedding rings.

Great Northern Railway geologists

West End "fills the order"...


TO PLANT 9/11 2:35 P M
HAZCO URGENTLY NEEDS EXTRA
HOPPER CAR SODA ASH FROM TANK
6 SHIPPED TODAY. ADVISE. END
TO OFFICE
CAN DO. WILL PULL CAR FROM
STORAGE SPUR AND SHIP TODAY.
CAR NO. NAHX 31078.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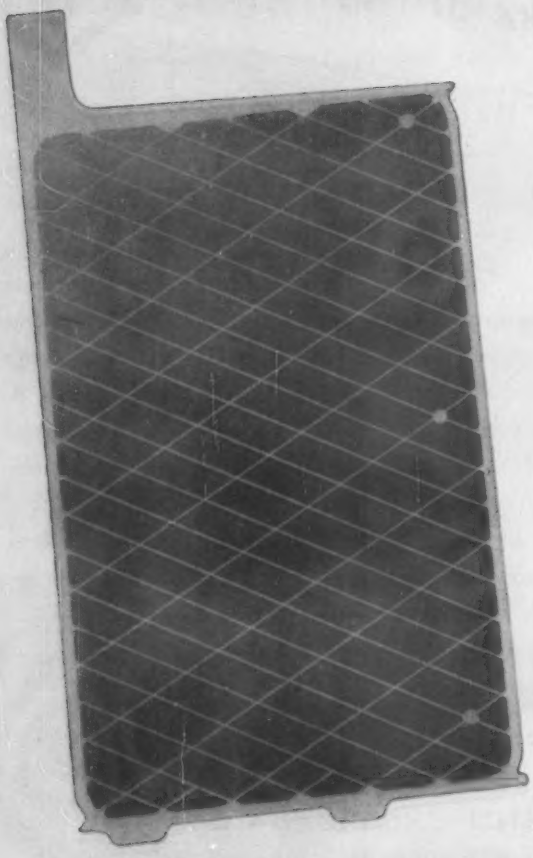

A vital contribution to motive power batteries, Gould's NEW Silconic Plate prevents grid corrosion, the most common cause of battery failure.

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Further overall strength is achieved when arsenic is added to the antimonial alloy of the plate, resulting in an extremely dense, homogeneous grid free of flaws. This new physical and chemical strength—together with Gould's compact battery design—add up to the best motive power battery you can buy. Write today or call your local Gould representative. He's listed under "Batteries Industrial" in the yellow pages. Gould-National Batteries, Inc., Trenton 7, N. J.

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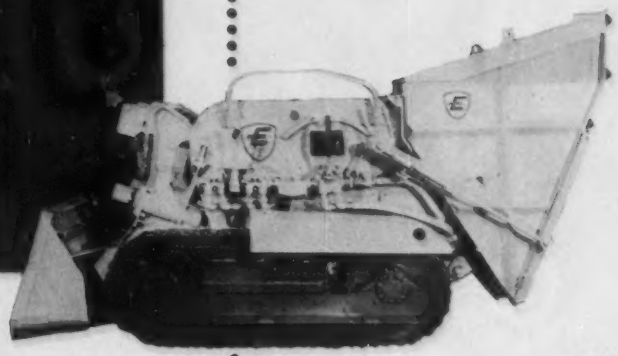

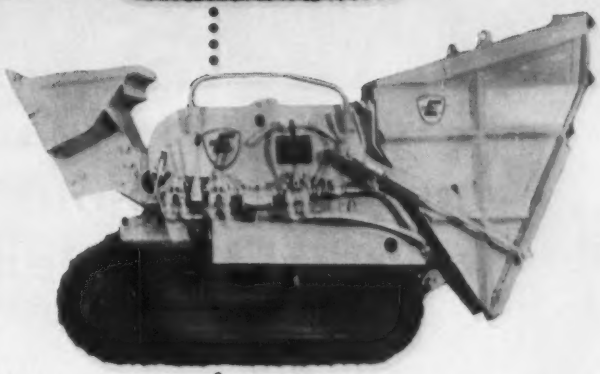

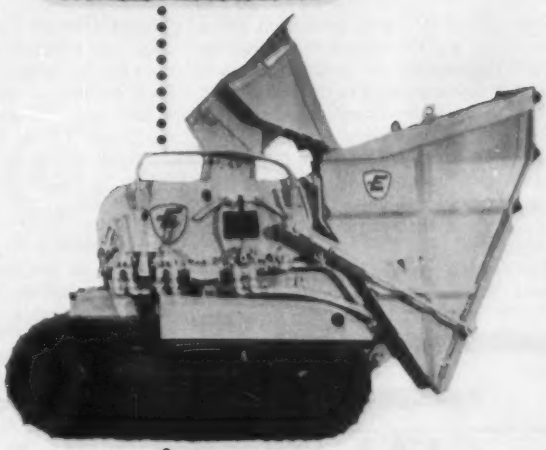

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Latest addition to the famous 630 series of compressed air activated, crawler mounted equipment, with a greater hopper capacity of 45 cubic feet. With an additional 5 cubic feet carried in the bucket, a payload of three tons (50 cubic feet), can be easily handled. The 631 will also be available for AC operation.

The Eimco 631 is self-loading, capable of both loading and carrying material. It is the answer to many and varied problems of developing and production-loading in stopes, drawpoints and other such areas.

Features include special long tracks for maximum stability and ground contact area; a positive semi-automatic hold-device, for holding loaded bucket in carrying position; heavy-duty and removable hopper with full opening door; improved, heavier equalizer bar; new, improved trunnions and brackets and additional track rollers for a crawler base capable of easily carrying these heavier loads.

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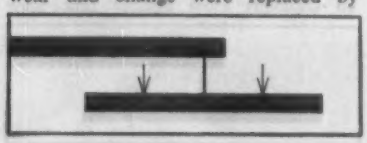
Knife-edged pivots that progressively wear and change were replaced by Thayer Flexure Plates that move only .001", yet accurately reflect the minutest changes in weight. This *firmly joined* lever withstands shocks and vibrations indefinitely. Dirt and dust are no longer a problem. Thayer guarantees this leverage system accurate for the life of the scale.



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Working in conjunction with straight electrical controls, it forms the most reliable, low maintenance system ever devised to control processing or materials handling *by weight*. Literature on its application to filling, batching and checkweighing operations is available on request.

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THAYER SCALE CORP. THAYER PARK, PEMBROKE, MASS.

Montana *(Continued)*

found "significant desposits of non-metallic minerals in a survey of the Great Falls-Billings rail line," the railway reported.

The geologists explored mineral resources in an 1100 square mile area east of Great Falls in 1958.

There are significant deposits of coal, clay, shale, bentonite, silica. sand, gypsum, limestone, gravel, shale and building stone in the area.

Included in the deposits is a subbituminous coal vein averaging 6 ft in thickness through much of a 200-square mile area in the Great Falls coal basin.

NEVADA

Fred Harvey Associates, who have spent approximately $100,000 in exploration work in Queen's Canyon of the White Mountain Range are making arrangements to install a 25 ton a day smelter. The ore has shown good gold, silver and lead for the past two years of operations. Due to the great distance to smelter no ore has been shipped out.

The company is at present shipping high-grade barium to the Los Angeles area from their other mines in Nevada.

Churn drill explorations of White Caps Gold Mining Co. Lowboy uranium mine has revealed values exceeding expectations, according to William Wilson, manager of the operation. The drilling program was started after a recent shipment of four cars of ore to the Vitro Mill.

LSZ Corp. at Pioche is producing high grade gold, silver and lead ore from the Yuba mine near Pioche which was last operated in 1896, at which time it was closed due to a cave-in. Early this year three men working with and under direction of James Hulse, LSZ president, timbered and repaired a 3,000-ft tunnel from which they sank a 300-ft winze. They then drifted 600 ft to a point just below the stope where miners last worked 63 years ago.

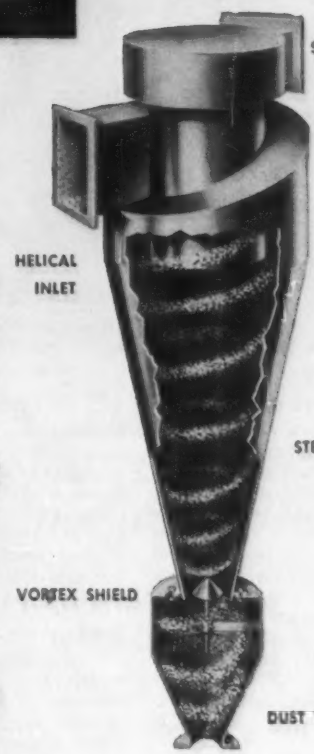
Apex Minerals Corp. which operates a uranium mine near Austin reports good results from an exploratory drilling program carried out in August. Fred Vollmer, Apex general manager, says diamond drills operated by Boyles Brothers passed through a wide aplite dyke and into blue metasediment at 285 ft which is expected to run high in values. A churn drill hole 100 ft from the diamond drill hole revealed a 52-ft vein of ore that runs .3%.

Apex has also signed an agreement with Goldfield Consolidated Mines whereby the latter firm will build Nevada's first uranium upgrading mill.

A new gold-silver ore discovery 20 miles east of Manhattan in Nye county was made recently by G. C. Staggs, Manhattan prospector, and development of the property has been taken over by Dr. Wallace Calder of Winnemucca, Dr.

(Continued on p 180)

. . . in dry dust control



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The exceptional performance of Duclone collectors is the result of these 6 unique features:

1. Small Diameter produces high efficiency
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AMC at Denver (*Continued from p 19*)

same period the Wholesale Price Index increased from 66.4 for 1928, to 126.0 for 1958.

Increase in cost for square-set mining was given as $4.207 per ton for 1927-1929, and $10.196 per ton for 1955-1959.

In a table listing direct mine operating costs for various mining methods the cost of labor as percent of total costs was given as follows: square setting, 71.2%; cut-and-fill, 56.7%; room-and-pillar, 43.7%; sub-level stoping, 56.9%; sub-level caving, 63.3%; block caving, 54.2%; open-pit, 36.4%.

Average explosive consumption per ton broken for various mining methods was listed as follows: square setting, weak ground, 0.5 lb; cut-and-fill, medium ground, 0.7 lb; sub-level stoping, strong ground, 0.4 lb; room-and-pillar, strong ground, 0.8 lb; block caving, weak ground, 0.14 lb; block caving, medium-strong, 0.35 lb; open-pit, 0.28 lb.

DONALD MCLAUGHLIN, of Homestake, criticized the Government policy of holding gold at $35 per oz.

More Science, Less Art

Dr. John S. Rinehart, director, Mining Research Laboratory, Colorado School of Mines, reviewed the various principles involved in the application of rock mechanics to mine planning. He predicted "It is inevitable that in the years ahead, mining will become more of a science and less of an art. Mines will be designed on a rational scientific basis, as are other important structures. The designers of the mines will be engineers, not scientists, the scientists' task being to provide the scientific foundation for the procedures used by engineers. The science of rock mechanics will contribute heavily."

Minton on Research

Research can do the following for mining, according to David Minton, Jr., vice president, Battelle Memorial Institute:

1. Reduce costs.
2. Show how to use by-products.
3. Indicate beneficial methods of diversification and integration.
4. Develop new uses for mine products.

Mr. Minton said: "The best prospects for direct cost reduction in mining and smelting operations would seem to be in further mechanization, and here the producing companies might fare better by shouldering their own unique developmental tasks rather than depending on suppliers. The old idea that development of equipment is the supplier's problem has been a drag around the industry's neck. The supplier, grateful as he is for new business, doesn't want to research an idea unless he thinks it will sell to a wide market. We have seen in recent years many examples of sharp cost reductions through mechanization: For example, the American Zinc, Lead & Smelting Co. reduced its manpower requirement at one mine by 52% through the development of a mining and mucking machine and increased its output per man shift by 33% by the mechanization of its Dumas, Texas, smelter. Other mines and smelters have shown similar gains, and the companies that have spent most on mechanization and the development of equipment to fit their special operations seem to be the ones looking hopefully toward further improvements."

Jurden on Cost Estimates

Wilbur Jurden, president, Anaconda-Jurden Associates, Inc., explained the necessity for accurate cost estimates in planning new projects, giving the following examples:

"As an example of the results that can be obtained by following this procedure, I might cite our most recently completed El Salvador project. Here we followed our usual practice of dividing the plant into its numerous components with a separate appropriation estimate for each one. By this process we prepared 132 detail estimates totaling more than $80-million and requiring the work of 7 men for 44 weeks. Possibly this appears to be a slow process to some people, but to those providing the money for the project,. the results are highly gratifying for our final costs were slightly below the estimated costs by a figure of approximately 2%.

"I must admit that this is remarkably close, but on this particular project we were favored with all of the desirable factors such as a highly skilled engineering organization, a carefully prepared estimate and an exceptionally efficient construction department, no strikes, no interferences and no serious delays. Under such conditions there is absolutely no excuse for over-running an estimate or for prolonging the construction schedule. Of course, such desirable conditions do not always exist, but I might add that on a recent compilation which we prepared for our own use on 11 jobs covering copper production, aluminum, uranium, iron ore and manufacturing plants and totaling nearly $600-million, the average margin of error between the actual appropriation estimate and the completed projects was 2.13%. I believe these figures will confirm the statement I made at the beginning of this paper to the effect that appropriation estimates can be accurately prepared given the proper engineering experience, the proper data and the time required."

Direct Reduction

In a paper "Trends in Iron Ore Beneficiation," Stephen Erickson, Director of Beneficiation, M. A. Hanna Co., commented "Development work on direct reduction continues to hold the interest of the industry. Several new processes have been announced but none of them, so far, appear to be economic except for special situations. There are no commercial continuous direct reduction plants in operation as yet, but in view of the large amount of work that is being done on these processes, it would appear to be principally a matter of time before they are used for commercial beneficiation of iron ores.

Concentrates Pipeline

D. A. Fraser, assistant mill superintendent, International Nickel Co., described pipeline transportation of concentrates and tailings at the company's Creighton mill in Canada. He said that the mill treats 12,000 tons of ore per day from which 1,800 tons of copper-nickel sulphide concentrate is recovered by flotation. The concentrate is pumped a pipeline distance of 7½ miles to the Copper Cliff concentrator for further processing. The standard length of pipe used in the line is 16 ft, but sufficient 8-ft lengths are used to facilitate making bends and connections into stations. Three sizes of pipe mounted on the pipeline trestles, 6-in., 8-in., and 13-in., are of wire-wound, wood stave construction with banded couplings. The wood is kiln-dried Douglas fir, pressure creosoted at 8 psi. Finished pipes are asphalt coated. The 8-in. and 13-in. pipes are designed for 100 psi pressure, and the 6-in. pipe for 75 psi. Wooden walls of the pipes are 1⅛ in. thick. Life expectancy of the pipes is at least 12 years for the 8-in. concentrate lines and at least 8 yr for the 13-in. tailing lines. Pulp densities of the flotation concentrate transported range from 25 to 35% solids.

Modern Zinc Mining

Average production of zinc concentrates from the nine mines operated in East Tennessee by New Jersey Zinc Co., American Zinc Co., and Tennessee Coal & Iron Division of U.S. Steel Corp. is approximately 13,000 tons per month, according to Johnson Crawford, assistant manager of mines, New Jersey Zinc Co., who described his company's mechanization program. He said average production per shift of a drill jumbo consisting of three Gardner-Denver model JBT booms mounted on a D-4 Caterpillar tractor is 150 tons. Studies have indicated that three drills on a

5 reasons why Atlas Copco's "TIGER" is best for stoping and all short-hole drilling!

(1) It's fast and easy to handle!

(2) It's easy collaring, with little recoil!

(3) Features a retractable air leg!

(4) Convenient controls, automatic back head!

(5) Operates on single air supply!

Here's the TIGER—a new, fast, compact rock drill with power and stamina to meet toughest drilling requirements! Its high percussion rate not only speeds penetration, but at the same time cuts recoil to a minimum. With controls conveniently located, collaring is unusually easy.

What's more, the automatic back head prevents dry collaring. Flushing water actually flows before drilling starts. And, the Tiger's "constant blowing" provision sends air through the machine the instant pressure is turned on, keeping water and cuttings from the rotation chuck.

There's still another "plus"—the Tiger's exclusive integral type pusher leg, with retractable piston rod. Operates on a single air supply!

This isn't the whole story by any means. For more facts about the amazing new Tiger rock drill and how it can speed *your* drilling, call your nearest Atlas Copco representative. Or, write to us at Dept. EMJ-10.

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6% increase in tensile strength

130% improvement in consistency of elongation

* Compared to belts previously manufactured

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ADVANCEMENT #1 **BALANCED BELT CONSTRUCTION** for the first time equalizes ply stress so that each ply pulls its full share of the load. **BBC** eliminates lazy plies. A BOSTON exclusive because only BOSTON can combine Electronic Tension Controls with Rotocure, the continuous method of vulcanization, which assures uniformity throughout the belt.

ADVANCEMENT #2 **DULON** markedly improves the aging characteristics of BOSTON belts. An exclusive BOSTON research development, the tough specially treated cover compound stays resilient longer . . . makes the belt much more resistant to abrasion, gouging, tearing and oxidation.

BALANCED BELT CONSTRUCTION plus **DULON** add up to longer belt life . . . less trouble in service . . . greater economy.

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Lima 1250 3½-yd. Shovel nears end of million-and-a-quarter-yd. excavating job on highway reconstruction project near Knapp, Wis.

"LIMA 1250 moves half million yards of rock—at 270-300 yards hourly!"

says Lawrence Gerke, Wisconsin contractor

The job was tough, the schedule tight. "In only 2 miles," says contractor Lawrence Gerke, of Merrill, Wis., "we had to excavate a million and a quarter yd. . . . almost half of it rock!"

High performance, low maintenance

The project involved reconstruction on U. S. Interstate 94 near Knapp, Wis. Gerke needed a high performance machine with low maintenance requirements. He says, ". . . After considerable analysis of equipment, we purchased a Lima Type 1250 for rock excavating. In many cases no blasting was done. Yet, working in this material, the Lima constantly averaged 270 to 300 yd. per hour. When shovel work was completed, the 1250 was easily converted in the field to a dragline."

The crawler-mounted Type 1250 has turned in outstanding performances everywhere as a 3½-yd. shovel, 85-ton crane, and variable dragline.

Air-controlled precision

Main operating and auxiliary functions are air-controlled for smooth, precision performance at full capacity operation. Choice of diesel engine or electric motor with torque converter.

Other features and available equipment include: Independent propel, extra-high-speed hoist attachment, third drum, power reversing hoist drum, two types of rigid and folding gantries. The 1250 can be knocked down to units of less than 60,000 lb. for haulage.

Whatever your job, there's a Lima type and size exactly right—½ to 6-cu. yd. shovels, cranes to 110 tons, draglines variable. Learn now why so many contractors agree with Lawrence Gerke when he says, "We are completely satisfied with the operation of our Lima." See your nearby Lima distributor or write to us.

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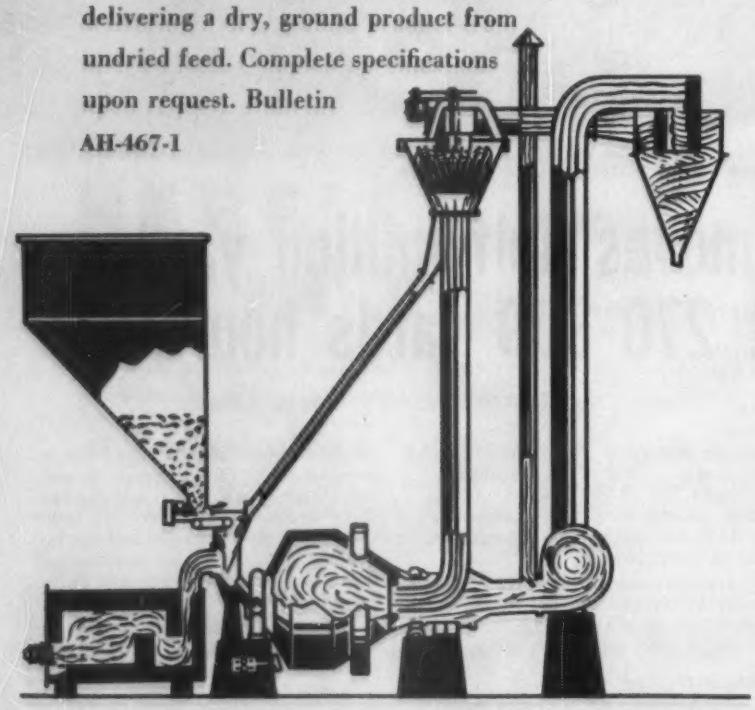
The Hardinge Gyrotor Classifier system, combined with a Hardinge grinding mill is an integrated grinding, classifying and product conveying system. Also available with an air-heating furnace for delivering a dry, ground product from undried feed. Complete specifications upon request. Bulletin AH-467-1



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AMC *(Continued)*

jumbo can be operated most efficiently by two men. Cost per ton of ore breaking including all labor, supplies, explosives and maintenance varies from 85 to 90c per crude ton. The following production statistics were given for the Jefferson City property:

Men on payroll	96
Shifts worked	1,952
Tons produced	38,323
Production shifts	811
Grade of ore	5.76%Zn
Tons produced per day	1,825
Tons per hourly shift worked	19.6
Tons per production shift	47.0

Hiring at Idarado

Reviewing recent activities at the Idarado Mine, at Ouray and Telluride, Colo., A. C. Highlander, general superintendent, summed up the company's hiring policy as follows:

"We feel that we have an excellent crew at Idarado. This is partly the result of training and partly a result of careful employee screening by the hiring foremen. All prospective employees are required to fill out application blanks after an initial interview, their references are carefully checked for their job capability, attendance records and safety record. Then they are required to pass a rigid physical examination before they are assigned to work. We believe that this system has paid off, for in 1956 in order to maintain a crew of 431 men, 386 were hired and 432 left; in 1957 in order to maintain a crew of 330 men, 119 were hired and 216 left; and in 1958 in order to maintain a crew of 300 men, 46 were hired and 72 left. Absenteeism has declined from well over 6% in 1956 to about 5% in 1958 for the operation as a whole."

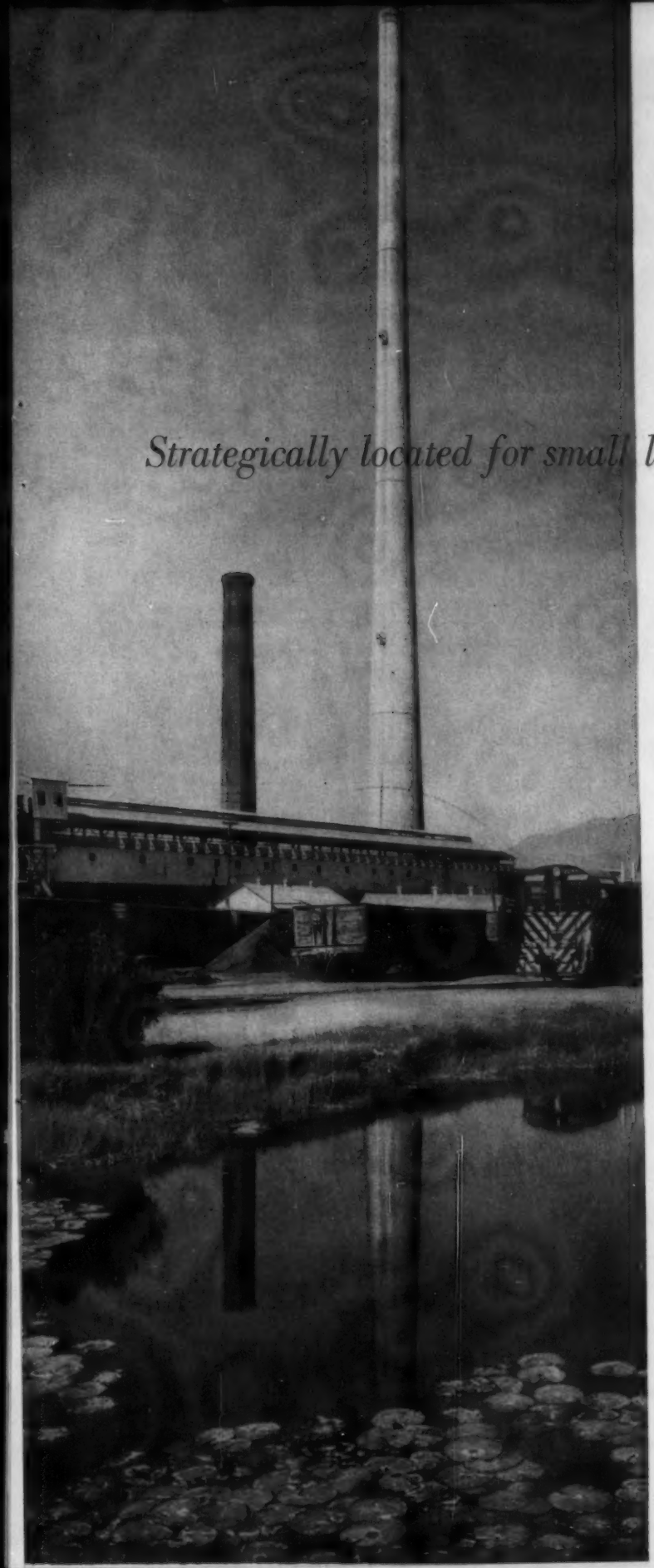
Shaft Sinking at Climax

William Distler, mine superintendent, Climax Molybdenum Co., described sinking methods of the company's new 19-ft dia shaft being sunk to an elevation 300 ft below the Storke Level. This new shaft will be required to maintain production which was increased to 33,000 tpd in 1956. Size of shaft was predicated on size of development equipment to be lowered and maximum tonnage of development ore to be hoisted daily. The cage compartment will be large enough to handle a 13-ton locomotive, a 10-ton ore car, a conveyor-belt type mucking machine, a loaded timber flatcar, or any piece of concreting equipment.

Process Control

At the conclusion of a talk on automation at the Anaconda mill, John Moore, superintendent of concentration, Anaconda Co., made this significant observation: "The word automation is sometimes interpreted as being correlated with unemployment as a capitalistic evil for amassing huge profits. In conclusion, I would leave the suggestion for your consideration that possibly a more suitable term would be process control."

In another paper by Francis Holderreed, director of metallurgical research, and William Yucy, assistant research



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See management at above locations or write to main office. American Smelting and Refining Company, Ore Purchasing Department, 120 Broadway, New York 5, N. Y.

58-54

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EVERY diamond is of uniform size, shape and structure throughout; hand picked from thousands with a skill born of 68 years in this highly specialized business.

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AMC *(Continued)*

engineer, Anaconda Co., described the use of X-ray analytical methods in process control at the company's copper concentrator in Montana.

The following table shows how closely X-ray assays compared with conventional wet chemical assays on % Cu:

Product	X-Ray	Chemical
Bulk Tails, 9 days	.15	.16
Bulk Tails, 5 days	.17	.16
Bulk Tails, 4 days	.17	.16
Bulk Tails, 4 days	.17	.16
Scavenger Tails, 5 days	.35	.48
Scavenger Tails, 4 days	.49	.55
Scavenger Tails, 4 days	.53	.54
Scavenger Tails, 4 days	.50	.50
Concentrates	26.8	27.1
Mill Feed	1.00	.98

Uranium Plant Costs

John Riddle, metallurgical engineer, Union Carbide Nuclear Co., outlined methods of developing mineral processing plants and estimating costs. Citing a uranium plant as an example, he said that cost estimates for the plant were $4.5-million. Actual costs were $4,653,000. A breakdown of costs for the plant appears in the accompanying table.

Uranium Plant Cost

Item	Cost, $000	Percent of Total
Process Equipment	1,490	33
Material, Equipment and Buildings	379	8
Field Labor	687	15
Subcontracts, Masonry, Roofing, Electrical	840	18
Freight	53	1
Sales Tax	42	1
Total Direct Cost	**3,491**	**75**
Const. Tools, Equipment, Supplies	225	
Temporary Facilities	27	
Tests	2	
Field Supervision	67	
Office Supplies and Communications	13	
Job Insurance	5	
Payroll Taxes and Insurance	90	
Subsistance	161	
Welfare	7	
Cleanup	10	
Total Direct Cost	**607**	**13**
Engineering (50% salaries)	360	8
Purchasing (42% salaries)	53	11
Contractor's Fee	142	3
Total Cost	**4,653**	**100**

"Schizophrenic" Interior

The United States Department of Interior was described as "schizophrenic" in a blast by American Mining Congress spokesmen against the wilderness proposal backed by the agency.

Typical of the comments on the department's "split personality" on the plan to set aside large areas of the public domain from which sportsmen, and commercial interests would be barred was that of W. D. Hagenstein, ex-

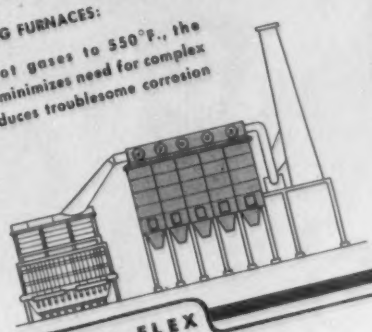
WESTERN PRECIPITATION'S NEW THERM-O-FLEX COLLECTOR

CLEANS GASES TO 550°F with VIRTUALLY 100% COLLECTION!

THERM-O-FLEX

FOR ZINC FUMING FURNACES:

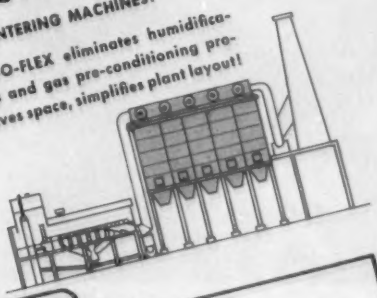
By cleaning hot gases to 550°F., the THERM-O-FLEX minimizes need for complex coolers and reduces troublesome corrosion problems!



THERM-O-FLEX

FOR LEAD SINTERING MACHINES:

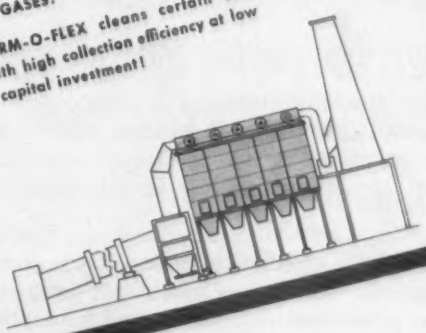
The THERM-O-FLEX eliminates humidification towers and gas pre-conditioning processes...saves space, simplifies plant layout!



THERM-O-FLEX

FOR KILN GASES:

The THERM-O-FLEX cleans certain kiln gases with high collection efficiency at low overall capital investment!



Western-Precipitation brings another important new advancement to the gas cleaning field — the THERM-O-FLEX Collector — a filter type of unit with many advantages over conventional filter equipment...

- The THERM-O-FLEX features silicone treated glass filter tubes that efficiently handle gases as hot as 550° F!
- The THERM-O-FLEX tubes are cleaned *automatically* by intermittent collapsing (not by destructive shaking). This assures uniformly low pressure drop combined with long filter life!
- The THERM-O-FLEX has *no moving parts* — nothing to require frequent servicing or replacement!

RESULT — highest collection efficiency combined with lower cost, less maintenance and uniformly low pressure drop on a wide range of applications, a few of which are shown at left.

Let Our Experienced Engineers study your dust or fume collection problem — *large or small* — and show exactly how **THERM-O-FLEX** gives new standards of performance at low installation costs. No obligation, of course!

HELPFUL NEW BULLETIN describes multiple Therm-O-Flex savings, outlines applications, technical data. *Ask for Bulletin #F105!*

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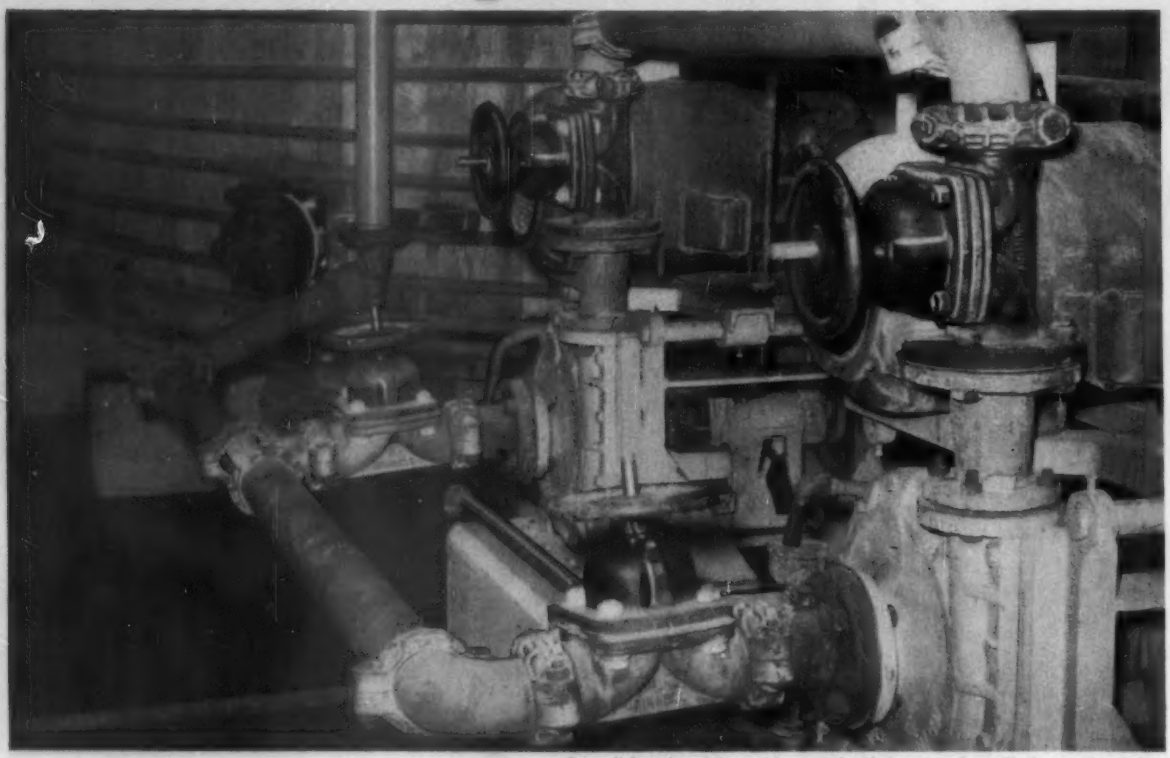
For fast, tight, dependable connections... Grinnell-Saunders Diaphragm Valves with grooved ends



Grinnell-Saunders valves with grooved ends in processing mill of a uranium mine.

Standard weir-type Grinnell valves, or the Straightway *(for straight-through flow)* enjoy wide usage on lines handling fibrous slurries, solids in suspension, sludges, semi-fluid materials, chemicals, water and gas.

Grinnell-Saunders Diaphragm Valves with grooved end connections permit flexibility in handling pipe misalignment, vibration and settlement. They also offer longitudinal tolerance which automatically compensates for contraction and expansion, and absorbs pipe length inaccuracies.

Grinnell-Saunders valves rate high in design features, too. They provide streamline flow in either direction, positive closure even when handling gritty or fibrous materials; complete isolation of bonnet mechanism; low cost maintenance — plus interchangeability of parts. Bodies are available in many different materials, including rugged ductile iron. In addition, linings and diaphragms may be had in a choice of materials to meet different conditions. Write for details.

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pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
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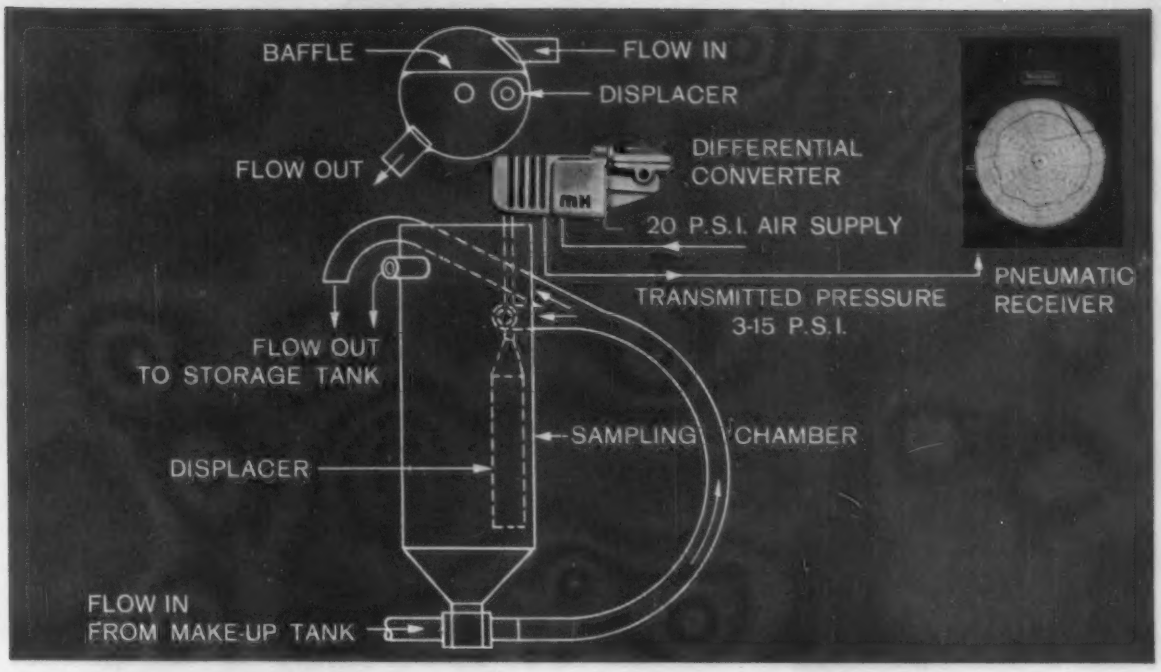

New system measures heavy slurry density . . .

simply, accurately, economically

This Honeywell system eliminates the high cost of radioactive methods and the difficulties of air bubble tube systems for measuring heavy slurry density. It is a simple, accurate displacer system.

A displacer, precisely calibrated for a specific density range, is connected to a *Differential Converter* to provide the density signal. This signal is transmitted to a receiving indicator, recorder, and/or controller.

The sampling chamber is designed to maintain the level of a truly representative sample of slurry so that the displacer is kept completely immersed. There's no clogging or build-up of solid material at the bottom of the chamber. Violent pumping surges are eliminated. Necessary circulation is maintained, so that slight changes in slurry density from the make-up tank are immediately sensed by the displacer and transmitted to the pneumatic receiver.

Honeywell supplies the entire system, including the sampling chamber. It is a sensitive, stable and trouble-free means of measurement, and permits the ready addition of conventional controls. Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

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In Cement and Aggregates the Word for Air Separation is "Sturtevant"

in cement . . .

Sturtevant Air Separators make possible highly efficient closed-circuit systems. Large circulating loads increase output, eliminate overgrinding. Ball and lining life lengthens, power costs are lowered. Top quality cement results from precise control of finenesses. Standard 16 ft. Sturtevants deliver raw fines up to 70 tph, finished fines up to 260 bph.

in aggregates . . .

Sturtevant Air Separators classify sand without water, clean sand by de-dusting it. Pre-classification by air can also increase screening production by removing screen-blinding fines. In blending operations, Sturtevants select desired fines from grinder throughput. This graded product is then used to overcome fineness modulus deficiencies.

Send for Air Separator Bulletin No. 087.

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Crushers • Grinders • Micron-Grinders • Separators
Blenders • Granulators • Conveyors • Elevators

AMC *(Continued)*

ecutive vice president of the Industrial Foresty Association.

"One of the strangest things about the wilderness bills are the built in conflicts between the bills in the Department of Interior," said the Portland resident.

"The Geological Survey encourages prospecting for minerals and for oil and gas. The National Park Service wants more parks. Yet the Department has reported favorably on the wilderness proposal.

"One wonders too, about the Department of Agriculture. It has administered the national forests for a half century under a policy of multiple use and yet endorses the idea of single use-wilderness by statute. The wilderness bill is in direct conflict with the policy of forest use and development.

"The population of the West is predicted to increase 50% between 1955 and 1970. These people will need jobs. This means further development, management, protection and use of our federal lands which constitute more than one out of every two acres in the West. These lands must contribute all they can to every economy. They are an important revenue source for local government which shares in receipts from the sale of timber, grass, minerals, oil and gas and other resources.

"When these receipts are denied local government, the local taxpayers will have to make up the deficits. These lands also provide a large share of our hunting, fishing, camping, hiking, boating, skiing and picknicking. To bottle up too much of them for a single use will deny most of us the use to which we are entitled as Congress reserved them for the use of all the American people.

"The question to be debated is: 'Jobs for the Many or Wilderness for the Few."

2.5-Million TPY

The intermountain phosphate belt is producing at the rate of two and one-half million tons of "rock" annually, according to Dr. O. E. Potier, director of mining operations at Pocatello, Ida. for J. R. Simplot Co.

He told the American Mining Congress that the phosphate deposits of Utah, Idaho, Wyoming and Montana contain 60% of the nation's reserves of phosphates.

"These deposits have been known for 60 years, but only in the last 15 years has any widespread interest been shown in them," he said.

Four electric furnaces require nearly two million tons of ore annually.

Johnson on Radiation

A spokesman for the Atomic Energy Commission said that many mines, some rivers and a few mills appear to have potentially dangerous concentrations of radioactivity above limits prescribed by the agency. The "limits" have been debated in the industry.

However, Jesse Johnson, director of the raw materials division of the AEC told the American Mining Congress that there was no evidence of anyone being harmed at present.

And he said that the situations could be corrected.

He also noted that it would be a long time before the effects of various types of exposure could be recorded.

Mr. Johnson said that there was very little danger from external exposure to radioactivity in mines, mills or in waters allegedly contaminated by uranium ore processing.

Such dangers as may be hypothesized would come from ingestion of radioactive material, through breathing contaminated air or getting the material into the body by eating or drinking.

In establishing the standards in 1957, The AEC said that for the general public radium and uranium limits for continuous exposure in unrestricted areas are to be one-tenth of those recommended in AEC publications. For working in mines and mills, the limits for concentrations on a continuous basis are three times higher than levels set forth in the published standards.

"Definite conclusions on the biological effects of the mine and mill radiation exposure are difficult because the potential hazards relate to possible long term effects. On this subject, there is lack of basic data, much of which could be obtained only by observation."

Mr. Johnson said that the earliest indication of a special health hazard in uranium mining came from experience in the Bohemian and Saxon mines of the Erz mountains where pitchblende was recovered unknowingly with silver, bismuth, colbalt, etc.

The hazard was "malignant tumor of the lungs," Mr. Johnson said.

In sampling six streams in 1955 involving eight uranium mills, it was developed that in only one case, that of the San Miguel River below Uravan, Colo., was the maximum permissible tolerance as established for the public exceeded.

In 1959, samples taken several places downstream from the Durango, Colo., mill showed tolerances two and a half times those prescribed for the public had been discovered.

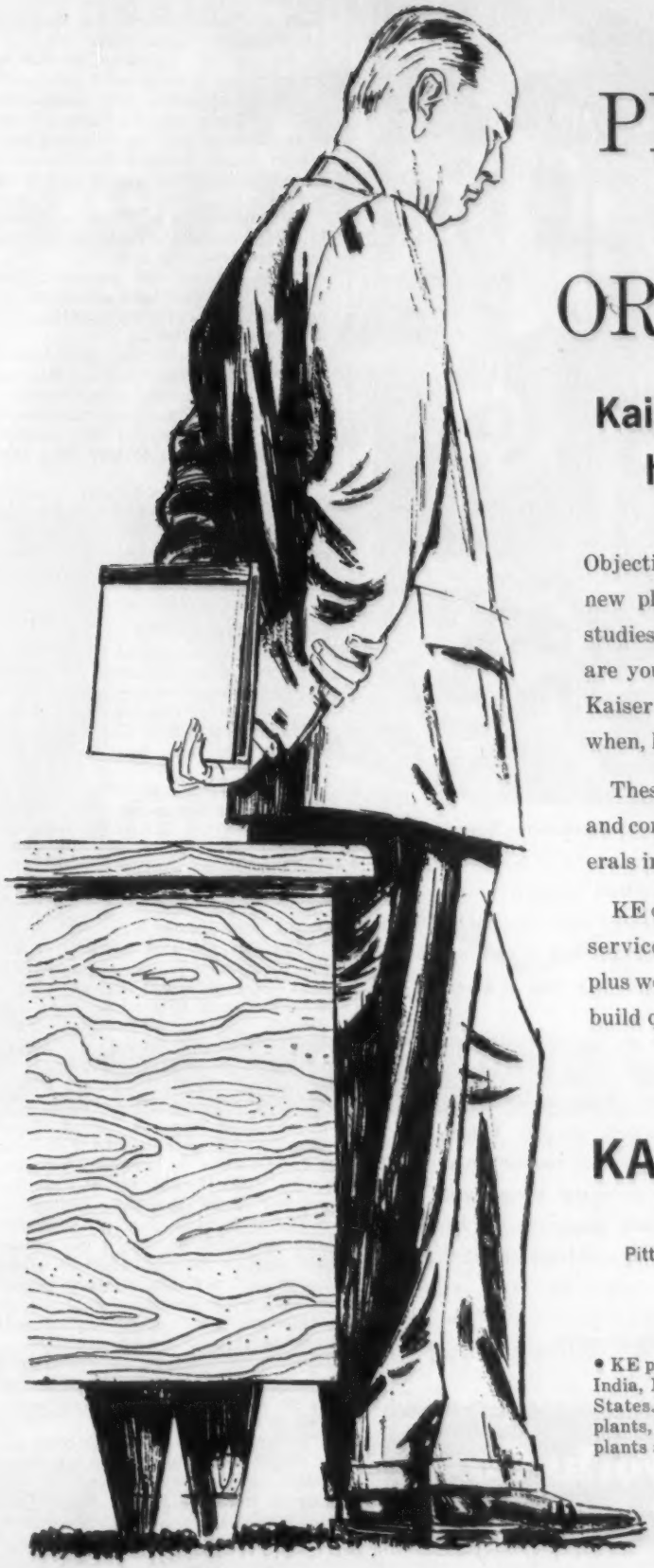
Mr. Johnson conceded that "there are some natural water supplies both in this country and in Europe which have a similar high radium content. They have been used for years as a source for domestic water," he said.

In any event, the Durango mill is taking steps to bring its mill effluent within limits prescribed by the AEC, said Mr. Johnson.

The official told the convention that "many underground uranium mines have a radon (gas) product concentration much in excess of recommended, permissible limits."

"The studies indicate that in most cases, good ventilation, using conventional equipment, will reduce the concentration of radon and its daughter products to acceptable levels. Some mines may have difficult problems because of insufficient number of shafts or connections to the surface," he said.

"Higher grade uranium deposits create



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Objective analysis is vital to sound decision on new plant or expansion projects. Feasibility studies, economic analyses and site evaluations are yours by an outside, impartial firm when Kaiser Engineers is selected to help you decide when, how and where to proceed.

These services are in addition to the design and construction of major facilities for the Minerals industry.

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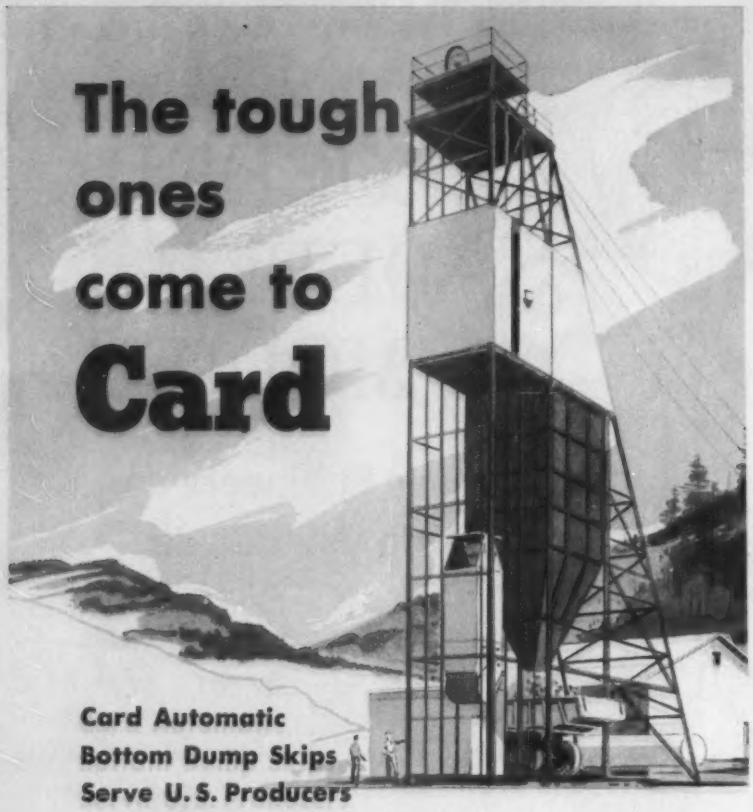

Card Automatic Bottom Dump Skips Serve U. S. Producers in most Major Mining Areas

This is a progress report on a relatively new idea. Beginning in 1956, increasing demand for the new Card automatic bottom dump skips has gradually brought them into service in a majority of the nation's principal mining areas—from Arizona to the Canadian line. In a typical operation two of these Card skips of approximately 150 cu. ft. capacity each are used to haul ore up a thousand-foot three-compartment shaft at a rate in excess of 900 tons per day.

In the initial year of operation, in one such installation, these automatic skips carried over 270,000 tons of rock before needing attention other than routine maintenance. The same successful design will prove out in your next project. It can be adapted to any capacity and specifications with ease.

Tell us your requirements.

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AMC *(Continued)*

more of a radon problem than the lower-grade deposits," he asserted.

"Because of the large number of mines, many of them small and poorly-equipped, inspection and enforcement will be a major task," Mr. Johnson said.

Mr. Johnson said that the major problem of uranium mills is the disposal of the waste products—effluent liquors and tailings.

"Effluent liquors must not be allowed to contaminate surface and underground water resources," he said.

"Mills utilizing wet processing (and they all do) should have no serious difficulty in maintaining safe working condition for employees".

"Proper dust collection, good hygiene in preventing ingestion while eating and drinking are essential," Johnson noted.

"The danger from small quantities of uranium concentrate in the digestive tract is more from toxicity than from radiation," he said.

"External radiation appears to present only minor problems. Both crude ore and uranium concentrate emit only low level radiation which is not considered dangerous under normal working conditions," he reported.

The Barter Switch

Agencies of the United States government would be permitted to acquire foreign produced strategic minerals to the exclusion of domestic mines under legislation approved by Congress, it was reported to the American Mining Congress.

U.S. Sen. Thomas E. Martin (R. Iowa) said that in a last minute shuffle before adjournment, the Democratic-controlled Congress approved a measure which would permit the agencies to utilize bartered agricultural surplus goods in a "trade" for the metals and minerals. (E&MJ, September, p 20)

With a multi-billion dollar farm surplus program facing the administration every year, this means that any domestic source would be precluded from sale of such "strategic" items as mercury, thorium, uranium, columbium, etc. to the Federal Government.

McLaughlin on Gold

The United States has denied ownership of gold to its own citizens in order to prevent a run on our reserves domestically, said Donald H. McLaughlin, president of the Homestake Mining Co.

"But at the same time, we practically invite foreigners to stage a run on our gold through the mechanism by which foreign central banks exchange American dollars for American gold.

"However, the withdrawals of gold from the U.S. by foreign central banks disproves the theories of the money managers. The European is still operating on the basis of gold being 'something of value.'

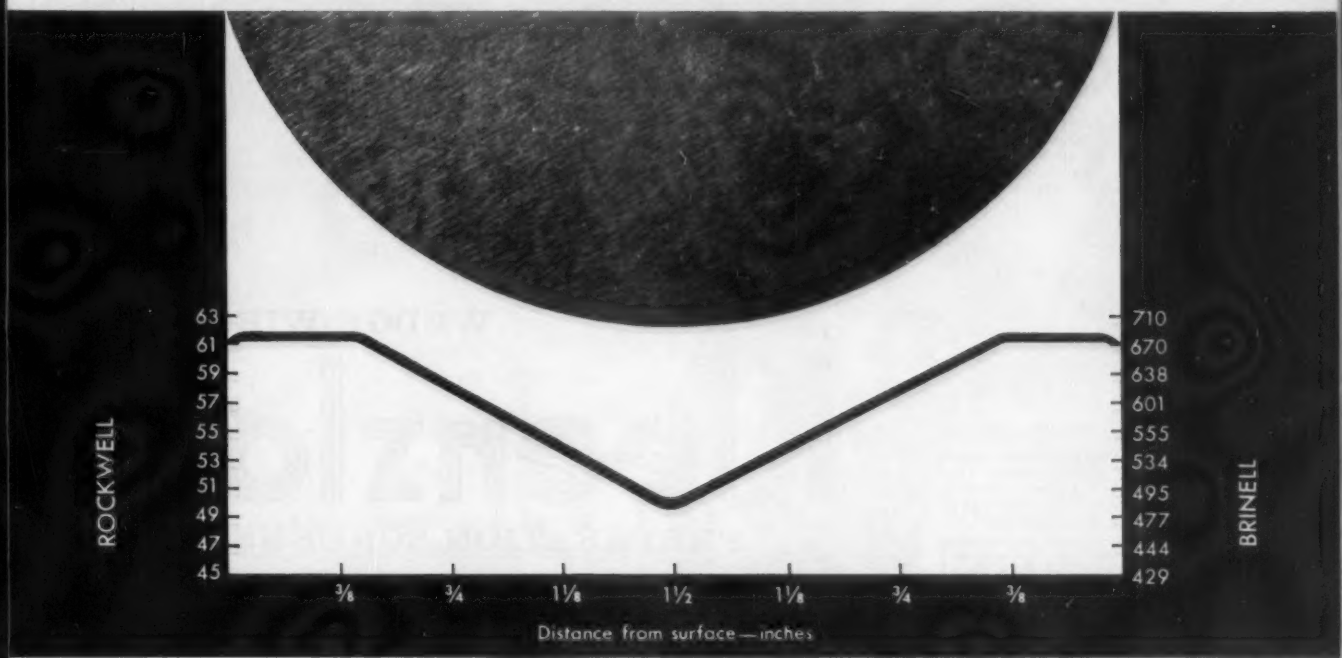
"If confidence in the dollar continues to decline in Europe, there will be a serious, continued withdrawal of gold reserves from the United States," Mr. McLaughlin said. "The drain could be serious. Revaluation of the dollar under

controlled metal hardness means

heat-treated cast alloy steel

NACO GRINDING BALLS

cut per-ton grinding costs



Note how new casting process and full heat treatment show controlled hardness between surface and inner core.

Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

Structurally, they possess a grain closely approaching tool steel—tough, hard and rugged for long lasting qualities. Laboratory tests show a remarkable uniformity in solidity, both under X-ray and specific gravity tests, with controlled hardness holding to a desired depth.

AA-5050

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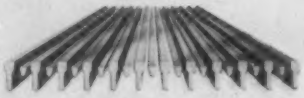
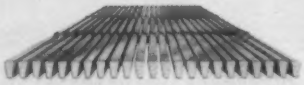
Established 1868

T-WEDGE KLEENSLOT



A new concept in guard bar design. T-shaped wire replaces typical "bar" to increase screening surface while keeping large unscreenable lumps of material above the tolerance governing lower screening surface.

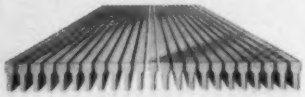
F217 and F250 KLEENSLOT



Manufactured with large size wedge shaped wires to maintain maximum efficiency over an extended period in abrasive applications.

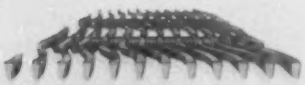
Although large in wire size, this screen will easily maintain openings as close as 1 m.m.

G187 and GB187 MIGH-TEE KLEENSLOT



Special profile increases wearing surface. This is a heavy duty precision type screen that will easily maintain openings smaller than ⅛ m.m. and openings larger than ordinarily considered economical.

"S" KLEENSLOT

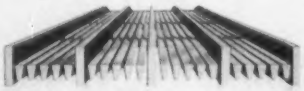


Engineered for applications where screening out of flats or slivers is of prime consideration. Can be also furnished in a "C" bend. Recommended for applications requiring openings larger than 1 m.m. For smaller openings, see Marcel screen.

MARCEL

This screen, while screening out "slivers," presents a flat surface for materials to wipe the opening clean. Available with openings up to 1 m.m.—for larger openings see "S" screens.

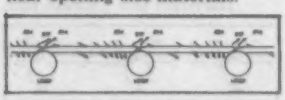
SCREEN GUARD



Vertical guard bars keep larger unscreenable materials above the actual screening surface. This increases screen life and promotes much greater efficiency in dewatering.

TAPER-SLOT

From loop to loop, the screen opening gradually increases. This design is to eliminate blinding when screening large amounts of near-opening size materials.



For example: .016 opening tapered to .024—the combination of opening sizes would be the same between each loop throughout the entire screen.

WEDGE-WIRE

REG. U. S. PAT. OFF.

Kleenslot

PREPARATION SCREENS

designed for vibrators or stationary applications for dewatering, screening, washing, extracting, filtering or sizing applications.

Wedge-Wire Kleenslot Screens are custom manufactured to your application and are available in many sizes, metals and finishes. Our engineering staff will assist you capably and promptly in obtaining the proper screen for highest production at lowest cost.

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SCREENS FOR INDUSTRY

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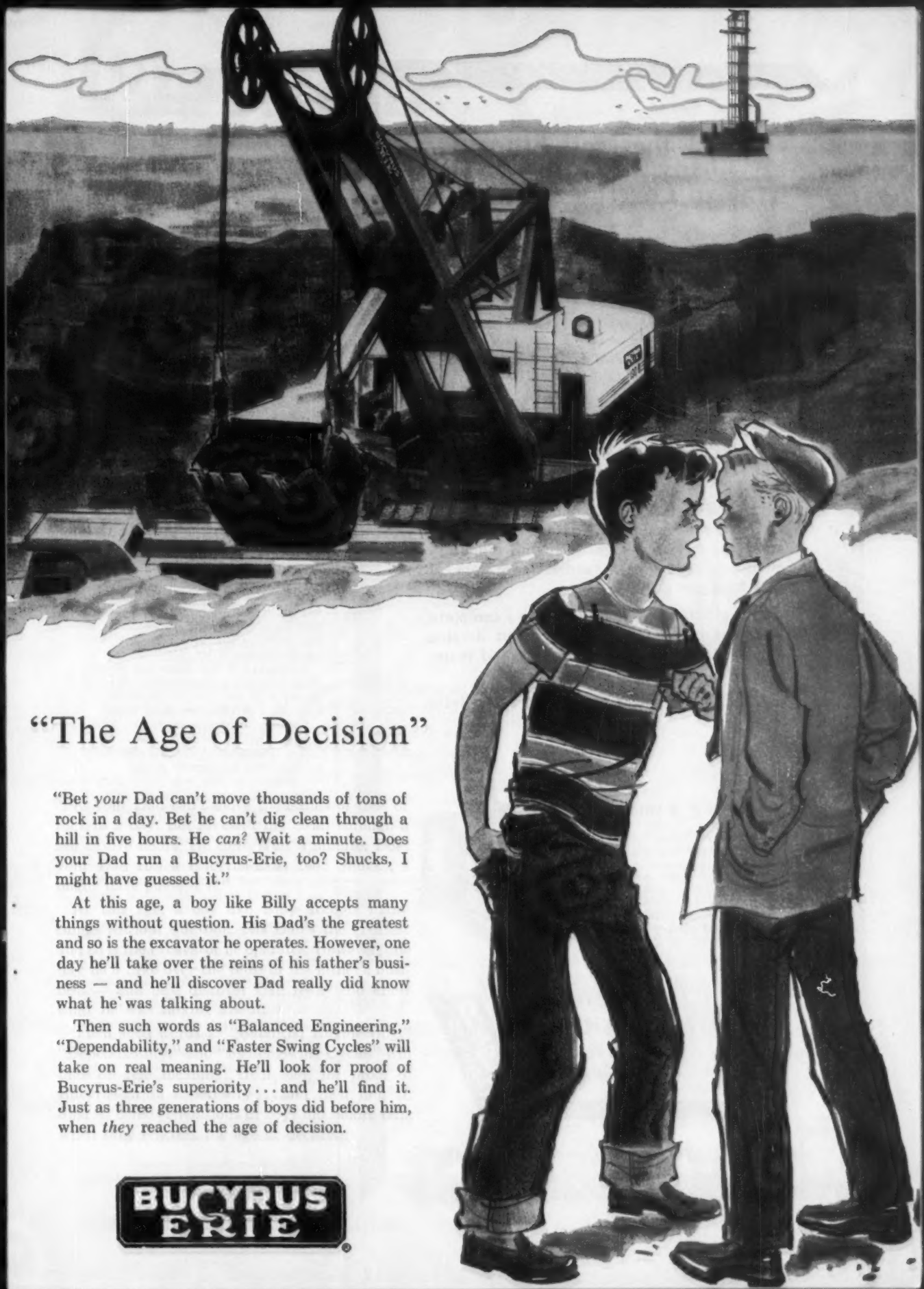


"The Age of Decision"

"Bet *your* Dad can't move thousands of tons of rock in a day. Bet he can't dig clean through a hill in five hours. He *can?* Wait a minute. Does your Dad run a Bucyrus-Erie, too? Shucks, I might have guessed it."

At this age, a boy like Billy accepts many things without question. His Dad's the greatest and so is the excavator he operates. However, one day he'll take over the reins of his father's business — and he'll discover Dad really did know what he was talking about.

Then such words as "Balanced Engineering," "Dependability," and "Faster Swing Cycles" will take on real meaning. He'll look for proof of Bucyrus-Erie's superiority . . . and he'll find it. Just as three generations of boys did before him, when *they* reached the age of decision.

BUCYRUS ERIE

STILL the Most Efficient Way to Concentrate Minerals

In 1940, when the SuperDuty® DIAGONAL-DECK® table was first introduced, it was a sensation in concentrating efficiency. Since that time, it has been constantly refined and improved, and is still unexcelled in the production of highest grade concentrates at lowest cost, for maximum recoveries with minimum loss to the tailings. With the volume of middlings reduced, it handles more tons of new feed per day.

This efficiency is attributable to a complete balancing of all tabling factors plus durable construction that trims operating and maintenance costs to the bone.

For complete information, send for Bulletin 118-C.

CONCENCO® Feed Distributor

While unexcelled for feeding concentrating tables, the CONCENCO Feed Distributor effectively provides an accurate splitting of feed into any desired number and proportion of parts to feed circuits or machines in battery for their greater overall efficiency. It is a heavily fabricated all steel machine with motor drive requiring 1 h.p. or less in operation.

THE DEISTER ★ CONCENTRATOR COMPANY
903 Glasgow Ave. • Fort Wayne, Ind., U.S.A.
CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

AMC *(Continued)*

such conditions might not be a matter of choice for our government," Mr. McLaughlin said.

He added that the efforts to resist internal inflation through increases in money rates is an admirable but "insignificant" step. Only by making the dollar convertible to gold and increase the value of gold can the nation put through the necessary deflationary steps at this time which would prevent more serious depression later.

Lasky on "Plowshare"

S. G. Lasky, staff assistant in the Department of Interior, said that the Plowshare program involving peaceful use of atomic energy in everything from desalting seawater to oil shale reduction was currently a "hodgepodge of the practical and the visionary."

"Many of the proposals seem like the direct products of brainstorming," he said. Mr. Lasky added that "my concern is not that some of the proposals seem farfetched, but with their origins. At least the mining proposals, which are the only ones I'm qualified to criticize, embody curious bits of misinformation and a certain degree of what I'd call technical innocence."

Requiem by Lewis

C. Hyde Lewis, speaking for the strategic minerals industry, offered a tally of the various metals and their fate in recent years. The president of New Idria Mining and Chemical Co., of San Benito, Calif. scored recent casualties as follows:

Antimony—A few years ago we supplied 40% of our requirements. We now import 95% and the 5% produced is a by-product of silver ore from Idaho.

Chrome—Producers in Alaska, Washington, Oregon and California have ceased operations. A chrome contract in Montana has six months to go.

Cobalt—The only true cobalt mine in the United States at Cobalt, Ida., is shutting down. Alternative supplies are in Fidel Castro's Cuba, "where large loans may not produce any cobalt in times of U.S. emergency.

Columbium—One columbium property in Idaho will shortly terminate operations at Bear Valley. Alternative supply: Africa.

Manganese—Government terminated domestic contracts on Aug. 5, 1959. There is no appreciable metallurgical grade manganese now produced in U.S. Alternative supply: Brazil and India.

Mercury—Government's mercury program ended in 1958 with the U.S. reportedly profiting on domestic production purchased. The 1959 output will be 20% below 1958 production. U.S. has almost exclusively patronized foreign cartels for current requirements.

Tungsten—The Bureau of Mines has ceased giving any tungsten figures. Production solely on by-product basis with output reaching a vanishing point.

E&MJ's on-the-spot coverage of the Denver meeting of the American Mining Congress begins on p 18.

Questions

We've been asked about the Yieldable Arch

"The Yieldable Arch weighs only 15 lb per foot. Isn't that like sending a boy to do a man's work?"

Strength alone is not the key to the Yieldable Arch's success. It is the "give," or yielding action, which keeps the ground under control as explained in the answer at upper right. If for some reason the joints failed to slide, then the Arch would become, in effect, a rigid set. This is why it is so important that the U-clamp bolts in the joints be tightened only to the proper tightness, and no more.

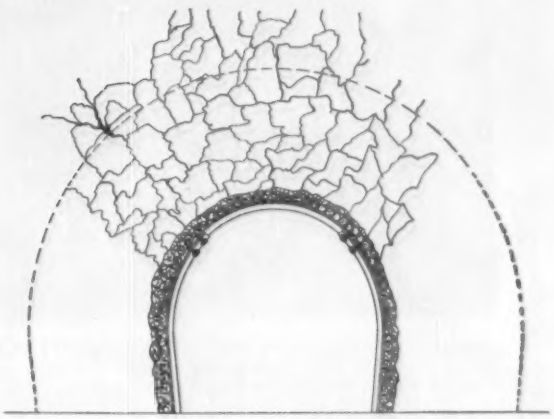
SEND US YOUR QUESTIONS

If you have any questions whatever, about the Yieldable Arch, or Ring, or ground control problems, by all means send them in. We will study your problems carefully, and reply as promptly as possible. Write to Room 1041, at the address below.

"Why does the Yieldable Arch perform better than rigid supports?"

The idea of a yieldable support is to let the ground slowly form its own natural arch. By yielding, the Arch transfers the weight back to the ground. When a natural arch has been formed, it then carries the major share of the load.

Rigid supports cannot return the pressures uniformly to the ground. Thus, no matter how heavy or husky they may be, rigid sets will ultimately fail in moving ground. And, of course, they impose continual maintenance problems.



YIELDABLE ARCHES MUST ABSORB RELAXATION UNTIL NATURAL ARCH IS FORMED.

"Suppose Yieldable sets should deform for some reason. Can they be salvaged?"

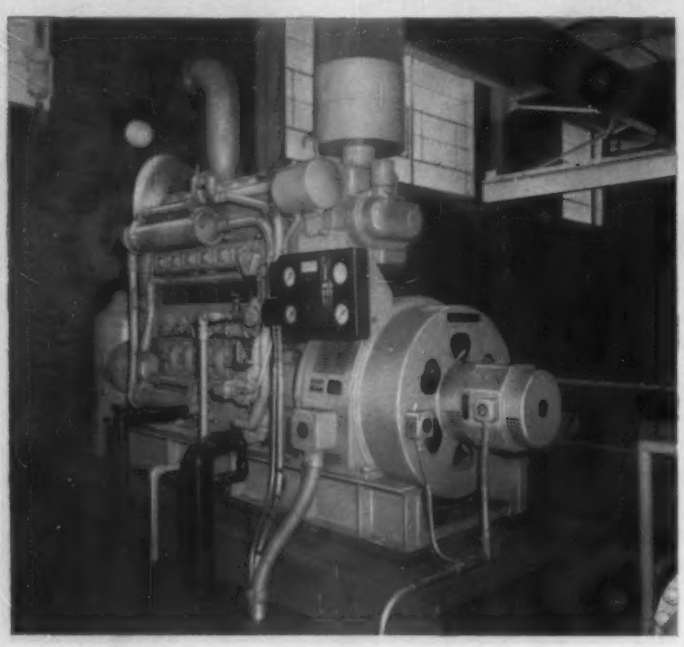
Frequently a deformed set can be re-shaped and restored to service. We know of one mine in the West which has had notable success in salvaging arch sets by first heating the segments, then straightening them under a large air hammer.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Picture of O-P economy!

Ohio pumping station saves $300 a month using **F-M** Opposed-Piston standby diesel for both power generation and pumping



Compact, lightweight Model 38F5¼ O-P is rated 450 hp. at 1200 rpm., direct drives a 175-kw. F-M alternator and, through right-angle gears, an F-M Pomona Vertical Turbine Pump with 5.5 mgd. capacity at discharge pressure of 105 psi.

Electric power off the flywheel end, high-service pumping off the front—that's the standby job cut out for this Model 38F5¼ Fairbanks-Morse O-P Diesel in the Elyria, Ohio water works serving 60,000 people.

Called into service for 3 to 6 hours a day in the Spring of 1958, the O-P pumped water for $1.50 less per million gallons than purchased power—a $300 per month reduction, including savings on demand charges. Each Saturday the engine makes a test run as the sole high-service on the line.

Versatile as well as economical, the Model 38F5¼ O-P is also ideal for direct-driving other equipment off the rear, with front end of shaft driving an auxiliary generator, crusher, pump, etc. The O-P can be furnished for either diesel, dual-fuel, or spark-ignited operation, and is available as a complete packaged unit with all accessories attached to the frame. Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

DIESEL, DUAL FUEL AND GAS ENGINES • LOCOMOTIVES • ELECTRIC MOTORS • GENERATORS
PUMPS • SCALES • COMPRESSORS • MAGNETOS • HOME WATER SYSTEMS

Nevada *(Continued)*

Reed C. Petty, of Van Nuys, Calif., Ray Deys, of Lancaster, Calif., and Helen Bixby, of Sherman Oaks, Calif. The ore is gold-silver telluride with heaviest values in gold. Best assay to date shows 2.90 oz of gold and 36 oz of silver. Staggs is a well-known Nevada prospector and was one of the original discoverers of the Jumbo gold mine in Humboldt County.

Nevada Mineral & Oil Corp. is continuing development in the Crow Springs and Gilbert areas of Nye County. The firm's holdings include deposits of selenium, nickel and cobalt, according to results shown from a recent core drilling program. Vic L. Smith, of Tonopah, is in charge of the work.

Dodge Construction Co. is shipping 15,000 tons of iron ore monthly to Japan from its mine in the Mineral Basin district of Pershing county. To meet the quota called for in a contract signed early in May, the firm is shipping an average of 21 cars daily during the five-day week. Ore is hauled by truck to Colado, a distance of 25 miles, where it is loaded on freight cars and shipped to the Port of Stockton. The contract is to extend for eight months.

Cordero Mining Co. (See E&MJ, March 1959 p 88) suffered a $150,000 loss during August when fire destroyed the power house, eight generators and two compressors at the company's mercury mine near McDermitt in northern Humboldt county. The blaze blacked out the entire mining camp operation and water supply and stopped the pumps which were keeping the mine dry. Bretz Mining Co., which operates a mercury property across the line in Idaho, lent Cordero a generator to keep the mine from flooding. A short circuit in one generator is believed to have started the fire. The Cordero is one of the nation's largest producers of mercury.

Standard Slag Co. is shipping 1,000 tpd of iron ore to Japan from its mine in the north end of Smith Valley in Churchill County. Work is on a five-day basis and shipments go by rail from Wabuska to the Port of Stockton. Standard Slag employs 45 men on the project and Wells Cargo which has the hauling contract employs six drivers.

Big Divide Mining Corp. has installed an underground core drilling operation in the Big Divide mine on Gold Mountain six miles south of Tonopah. First station is 726 ft in from the tunnel portal and several holes will be drilled to prospect territory at lower levels. Superintendent Jim Smith reports that the mine's main shaft has been opened to the 1,000-ft level and is now in good condition to use.

NEW MEXICO

Quinta Corp., mining and real estate company, has announced the first part of 1960 as the target date for initial

Increase grinding mill efficiency...
with CF&I Grinding Media

The Image of CF&I helps assure increased output in grinding mill operations—through the use of long-wearing, tough CF&I Grinding Balls and Grinding Rods.

The special analysis steels used in these products give an ideal balance between hardness and toughness—thus affording optimum grinding ability plus maximum wearability.

CF&I GRINDING BALLS are hot-forged and carefully inspected throughout production and immediately before shipment to assure that they are free of surface pits, circumferential ridges or other surface imperfections. They have excellent resistance to both abrasion and impact, and operate economically in either high or low speed mills. Available in diameters from ¾″ to 5″.

CF&I GRINDING RODS are hot-rolled of a special long-wearing steel which minimizes both bending and premature breakage. All rod ends are square cut and rods are of proper length to fit the mill in which they will operate. All rods are machine straightened to assure maximum line contact between the rods for the full length of the mill. These properties help facilitate rod line-up in the mill and eliminate tangling of the charge. Available in ½″ increment sizes from 1½″ to 4″ in diameter and in various lengths.

For complete information and service on all CF&I Mining Products, contact the nearest CF&I sales representative.

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY
CF&I Mine Rail and Accessories • CF&I Rock Bolts and Realock Metallic Fabric
CF&I Industrial Screens • CF&I-Wickwire Rope • CF&I Grader Blades

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MINING PRODUCTS
THE COLORADO FUEL AND IRON CORPORATION

In the West: THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso • Farmington (N. M.) • Ft. Worth • Houston
Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Wichita
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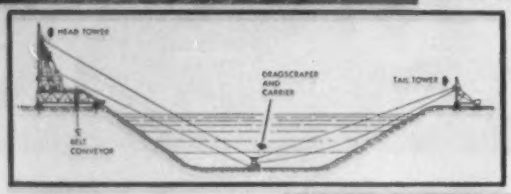
Tough Digging, Long Hauls... Routine Jobs for Sauerman DragScrapers

240-Ft. Bank... 350-Ft. Haul

This mobile Sauerman Tower Excavator digs 480 yds. per hr. on an average haul of 350 ft. from a high bank to a portable field hopper. The 12-yd. Crescent DragScraper operates between steel head and tail towers. The towers are mounted on two sets of railroad tracks and ride on four sets of trucks. DragScraper power is supplied by two hoists mounted on the head tower. One hoist operates the load and pull-back cables, the other is used to tension the track cable. The hoists are controlled by one operator located in the cab on the tower. The load cable handles over 400,000 tons of material before replacement.



Drawing shows typical mobile tower excavator digging in wet pit.

75 Ft. Under Water... 800-Ft. Span

A 5-yd. rapid-shifting DragScraper supplies about 200 yds. per hr. to the plant hopper in background. Bridle tower in foreground is one of two supporting the bridle shifting cable which is controlled by the third drum of the Sauerman hoist. Lateral shifting of the DragScraper's line of operation is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The DragScraper is digging 75 ft. under water and the operating span is 800 ft. from head frame to the bridle towers. Over a million tons have been excavated from this pit. The DragScraper often operates 24 hrs. a day to handle contract demands.

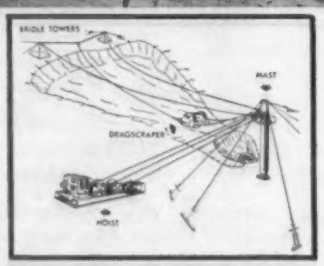


Diagram shows details of Sauerman rapid-shifting DragScraper.

Sauerman machines dig and haul in one continuous operation . . . work on high bank, dry pit or under water . . . handle most bulk materials. Consult Sauerman engineers about your job. We will promptly supply appropriate literature.

SAUERMAN BROS., INC. 626 SO. 28th AVE. BELLWOOD, ILL.
Linden 4-4892 • Cable CABEX—Bellwood, Illinois

Crescent Scrapers • Slackline and Trawline Cableways • Durvlite Blocks

New Mexico *(Continued)*

mining and production on the 20,000-acre Church Rock uranium properties located near Gallup, which Quinta owns jointly with Phillips Petroleum Co.

In an announcement following a board of directors' meeting Aug. 11, Quinta president, Victor Salazar, revealed that work is presently under way on a 10-ft diameter shaft with a daily capacity of 1,000 tons of uranium ore. Under the terms of the agreement between the two owing companies, the entire cost of sinking and equipping the mine shaft will be borne by Phillips with the latter company recovering its cost out of the initial production of the mine.

NORTH CAROLINA

H. T. Jackson of Greensboro has formed the Kershaw Mining Co. to work the tailings left from former operations at the Davis Gold Mine near Lugoff, S.C.

He said there is about $15 worth of gold in each ton of tailings at the site which until now have been unprofitable to re-mine. Now, however, he says a new cyanide process will make it pay and he is shipping the tailings to Waxhaw, where a plant is handling tailings under the process.

Lithium Corporation of America announced Aug. 26 that it will resume large-scale mining of lithium-producing spodumene ore in deposits near Bessemer City next year.

Much of the nation's known heaviest deposits of lithium ore are concentrated in a band running from the Bessemer City area to Gaffney, S. C., and the company controls heavy deposits in a 15-mile radius of Bessemer City.

TENNESSEE

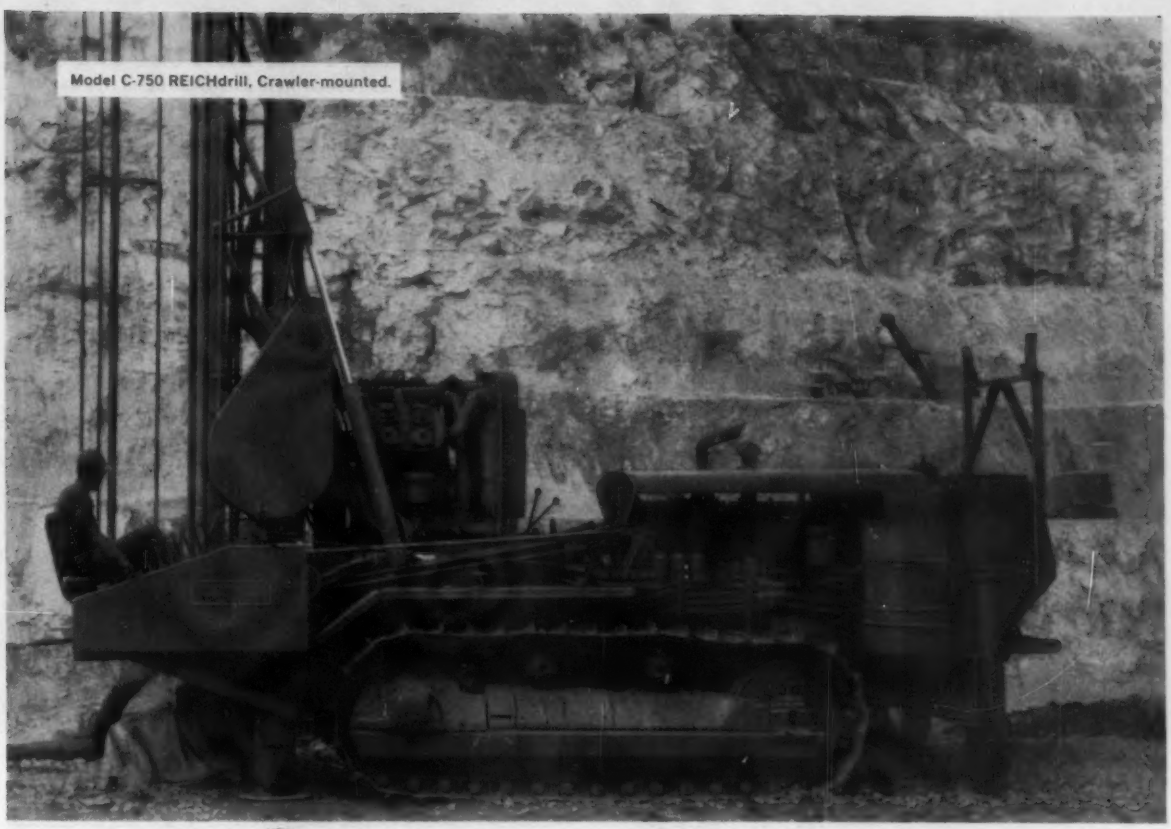
A new shaft is being sunk by Tennessee Copper Co. at Copperhill. This new shaft, now only 75 ft deep, will eventually intersect the "School House" copper orebody. Primary purpose of the shaft is to transport men and materials to the new stopes. All ore will be framed through a drift 6,000 ft long to the Central Shaft, the main ore hoisting shaft at Copperhill.

Production from the School House orebody will partially replace the production lost when Tenessee Copper's famous Burra-Burra mine was closed down early this year. It is expected that Tennessee Copper will continue to mine close to 1-million tons of ore each year.

TEXAS

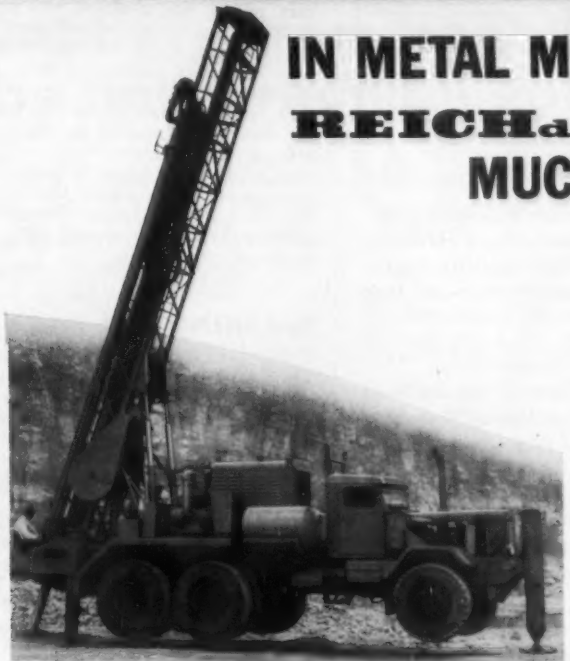
Susquehanna-Western Corp., operating the Riverton, Wyo. uranium mill, has succeeded Union Carbide Corp. as a partner in projected developments of uranium mine and mill near Alice, of Palangana Corp.

Susquehanna Western, a subsidiary of



Model C-750 REICHdrill, Crawler-mounted.

IN METAL MINING REICHdrills give you MUCH more hole per day



Model T-750 set-up for angle drilling, an exclusive REICHdrill feature. Units can be economically mounted on used highway trucks if desired.

And here are 4 rugged reasons why:

1. Variable rotation speed gives you exactly the right RPM for any material, rock to rubble.

2. Minimum of control levers for all operations means fast, easy handling by one man.

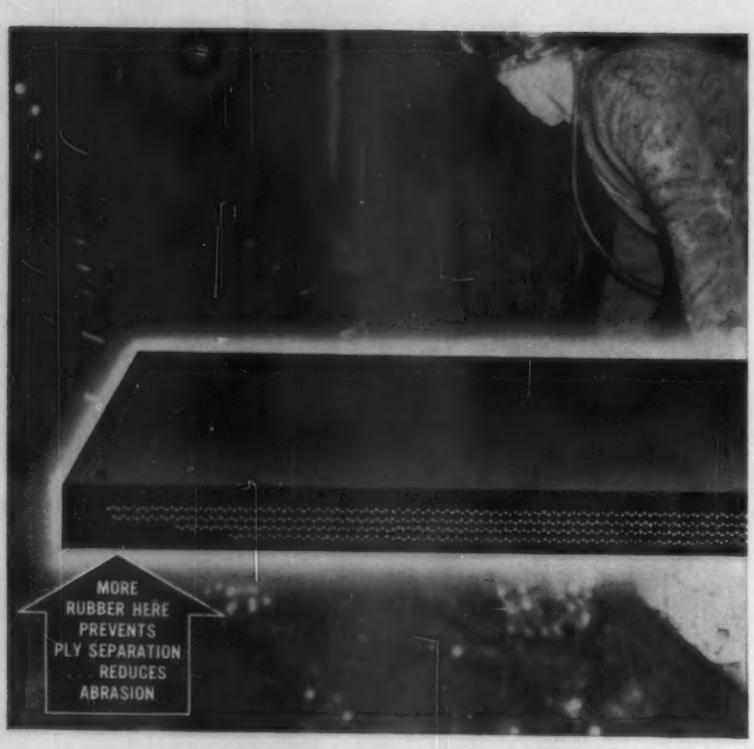
3. All controls actuated by smooth hydraulic power, saving operator time and tiring.

4. Extra heavy-duty construction on all component parts, including pumps, gears and frame means rig can take long, high speed duty without costly maintenance. Plus other field-proven features like hydraulic stem loader and down-the-hole hammer.

Units can be supplied truck or crawler mounted to suit operating conditions. Hole up to 12" diam. Down pressure to 75,000 lbs. Write for detailed information on REICHdrills.

REICHdrill *Division: Chicago Pneumatic Tool Company*

1439 ASH STREET, TERRE HAUTE, INDIANA



EXCLUSIVE "COLEDGE"* CONSTRUCTION

gives Quaker Thermoid Conveyor Belting extra life where it counts

Unique "Coledge" construction puts more rubber *at the edges* where it's needed, prevents ply separation, makes a more flexible and wear resistant edge where abrasion is greatest. Punishment at the edges—especially the tough use dealt out in mining—can kill most conveyor belting in a fraction of the lifetime of Thermoid-Quaker belting.

Tests show Thermoid-Quaker "Coledge" construction lasts and lasts on the same jobs where other belting fails. "Coledge" construction is available on all grades of Thermoid-Quaker belting.

What's more, all Thermoid-Quaker conveyor belting is prestressed in manufacture, so that the belt is actually in compression when you get it—ready for the heaviest load without strain.

Examine Thermoid-Quaker Belting with the exclusive "Coledge" construction at your Thermoid distributor's, or write for further information to Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Streets, Philadelphia 24, Pa.

*Patent Applied For

THERMOID PORTER DIVISION

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION; and in Canada, Refractories, "Dissston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

Texas *(Continued)*

Susquehanna Corp., Chicago, Ill. holding company, would develop metallurgy and the mill in the Palangana partnership which controls some 1-million tons of indicated ore on Palangana salt-sulphur dome with average grade running 25% U_3O_8.

The project has lain dormant for many months because initial mine reconnaissance disclosed presence of water, some natural gas and high temperatures at around 1,000 ft. The uranium in unconsolidated sand sections is found on flank of the dome, it has been reported.

Other partner to the Palangana Corp. program is Columbia Southern Chemical Corp.

Negotiations on the proposed 600 tpd mill near Alice have been opened with Grand Junction Operations Office of the Atomic Energy Commission.

UTAH

A number of prominent Utahns have formed Amalgamated Chemical Co., controlling some 50,000 acres in potash prospect permits in southeastern Utah and southwestern Colorado.

President is oilman N. G. Morgan, Sr.

Treasurer and director is Orval W. Adams, retired president of Zions First National Bank and former president of the American Bankers Assn. Vice presidents and directors include Louis Buchman retired vice president and general manager, western mining divisions, Kennecott Copper Corp. and Gus P. Backman, executive secretary, Salt Lake Chamber of Commerce.

Secretary is Virgil V. Peterson, a partner with Mr. Morgan in the oil firm of Morgan and Peterson.

Most of the holdings in potash permits extend southwestward through Lisbon Valley in southern Grand and northern San Juan Counties, Utah, into southwestern Colorado.

WASHINGTON

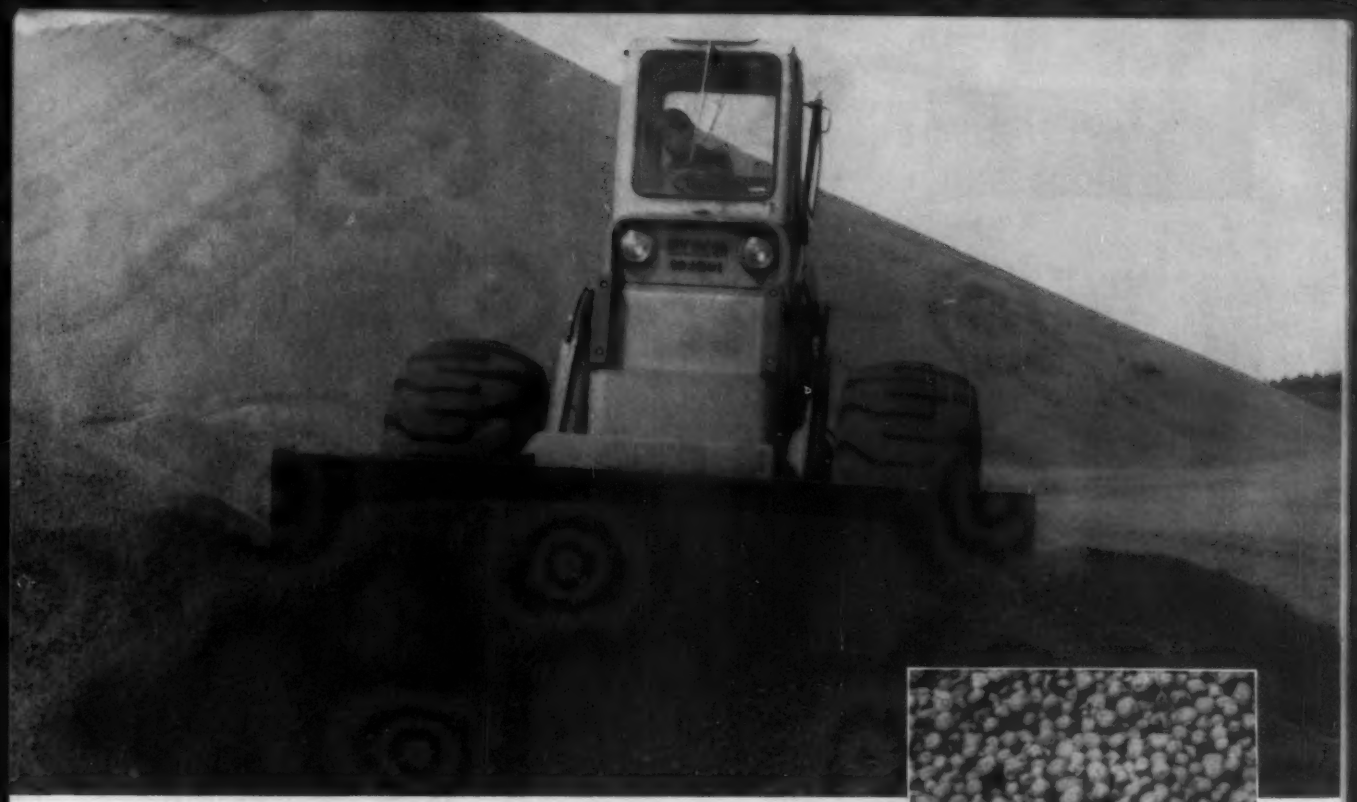
The mineralized zone now being mined in the Metaline district of northeastern Washington could contain an additional 146-million tons of zinc-lead ore, a government geologist testified at a Federal Power Commission hearing at Spokane, Aug. 20 and 21.

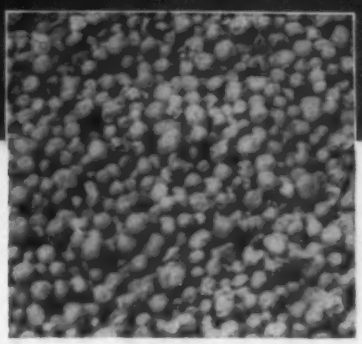
A. E. Weissenborn, regional geologist for the United States Geological Survey, offered the testimony at a hearing on the applications of Seattle City Light and the Pend Oreille County Public Utility District to build hydroelectric projects on the Pend Oreille river near the Canadian border.

WYOMING

A group of Sweetwater County residents have filed on 10 halloysite claims eight miles southeast of Rock Springs.

The claims are in sections 26, 22 and





Typical Mesabi Range material: abrasive, heavy

Rubber-tired machines the only practical solution

From a distance it looks like any other stockpiled material. Then you come close and you see *this is something different*—something that combines many of the worst characteristics of sand, gravel, even rock. It's abrasive. Dead. Heavy. You've heard the name. It's *taconite!* Processed taconite! Round pellets, varying from a half-inch to three-fourths inch in diameter, blue-gray in color, 63% pure iron.

When rubber-tired machines can handle such material *successfully*—day in and day out—with rubber's obvious advantages of mobility and no track wear—that's real news for maintenance-minded firms that have almost *any sort* of stockpile or feeding problem.

This Minnesota taconite plant has *five rubber-tired Michigans.* These include a 2¾ yd Model 175A, a 2 yd 125A, and two 1¼ yd 75A Tractor Shovels . . . and the 262 hp Model 280 Tractor Dozer pictured. The Tractor Dozer exemplifies Michigan advantages . . .

Advantage No. 1—Tire Life

This 56,000 lb machine started work about a year ago. To date, its tires show virtually no wear. The machine does a variety of jobs. For example . . .

Advantage No. 2—Mobility

1. Levels the multi-million ton taconite pellet and stockpiles. Machine works on 2-to-1 and 3-to-1 slopes, has surprised men on the job with its ability to climb steep grades on loose footing.

2. Cleans around the 10-yard pellet-loading shovel. Major advantage in this operation is way Michigan's low-pressure tires don't crush the pellets . . . a real problem with crawlers.

3. Maintains haul roads.

4. Tows disabled trucks.

5. Cleans spillage around distant pellet plant. Unit gets to this assignment, 2 miles away, at 28 mph, travels under own power without waste of lowboy loading or unloading, does no damage to RR tracks or blacktop roads.

6. Cleans under hopper. Here, operator dozes normally until he accumulates load. Then he hydraulically pivots blade back, lifts material, turns and dumps outside of rail tracks.

Advantage No. 3—Dependability

Key to Michigan success, however, has been dependability! Entire power train of each machine—torque converter, power shift transmission, planetary axles—is designed and built by Clark, specifically engineered to give more usable power and traction than you've ever seen on rubber. Get the proof of a demonstration. Four Michigan Tractor Dozer models—162 to 600 hp—eight Michigan Tractor Shovels—16 cu ft to 6 cu yds—to choose from.

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B-52 *pacemaker*

HYDRAULIC ROTARY DRILL with the exclusive **Hollow Stem Auger** . . . *lets you sample while you bore!*

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Mobile Drill's new B-52 PACEMAKER brings you unequalled versatility to meet today's demand for greater drilling speed and flexibility. Here's a rugged, powerful, heavy-weight workhorse that mounts on 1 or 1½ ton vehicles and will drive 5' sectional augers to 150' . . . N rods to 600' . . . and A rods to 1000'.

BIG POWER . . . BIG PERFORMANCE!

PACEMAKER's twin hydraulic feed develops 10,000 lbs. hydraulic ram force! Rig has own independent power plant, variable speed control on rotary drive.

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Custom mountings are designed to meet your needs, special body fabrications provide storage racks for augers and watertight compartments for tools and accessories . . . everything to make the PACEMAKER a mobile, fast moving, time saving unit.

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22' TOWER—Permits withdrawal of rods in 20' lengths. Mechanically operated, jackknifes to horizontal position for safe, legal highway travel.

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OFF-THE-HOLE HYDRAULIC BASE—Rail-mounted base slides out of way while adding or withdrawing drill sections, assures continuous perfect alignment. Hydraulically operated.

time-saver no. 3

CENTRALIZED 1-MAN CONTROL GROUPING—Located on operator's side of drill base, within easy reach. Fingertip controls plus advanced safety design increases operator's efficiency.

time-saver no. 4

NEW, *EXCLUSIVE* HOLLOW STEM AUGERS—Actually permit all types of sampling while you bore! Augers form their own casing, also allow coring through hollow stem after rock has been reached.

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Wyoming *(Continued)*

34 in Township 17 North Range 104 West, about midway between Little Bitter creek and Salt Wells creek.

The claims on the soft white silicate of aluminum were filed by Charles R. Holland, Jack T. Simon, Marion M. Fidlar, Lucas W. Folsom, Edward R. Keller, Burford W. Craft, Harley M. McCamish, Warren W. Skeeters, William Williams and Bernard Z. Kastler Jr., most of whom are associated with Mountain Fuel Supply Co.

A contract to strip 60,000 yd of overburden on the Sage Brush claim of Federal-Radorock-Gas Hills, partners in the West Gas Hills area, has been awarded to Gilpatrick Construction Co. The stripping will open a pit for mining uranium ore for the combine's processing plant slated for completion this fall.

Ruby Chemical Div. of J. R. Simplot has set up exploratory crews in western Sweetwater County to explore trona deposits.

Diamond Alkali Co. and Stauffer Chemical interests are already exploring deposits in the same area.

IN CANADA

BRITISH COLUMBIA

Forty-second annual series of prospectors' training classes sponsored by the B.C. & Yukon chamber of mines were to open in Vancouver, Oct. 13. Lectures will be given twice weekly for three and one-half months.

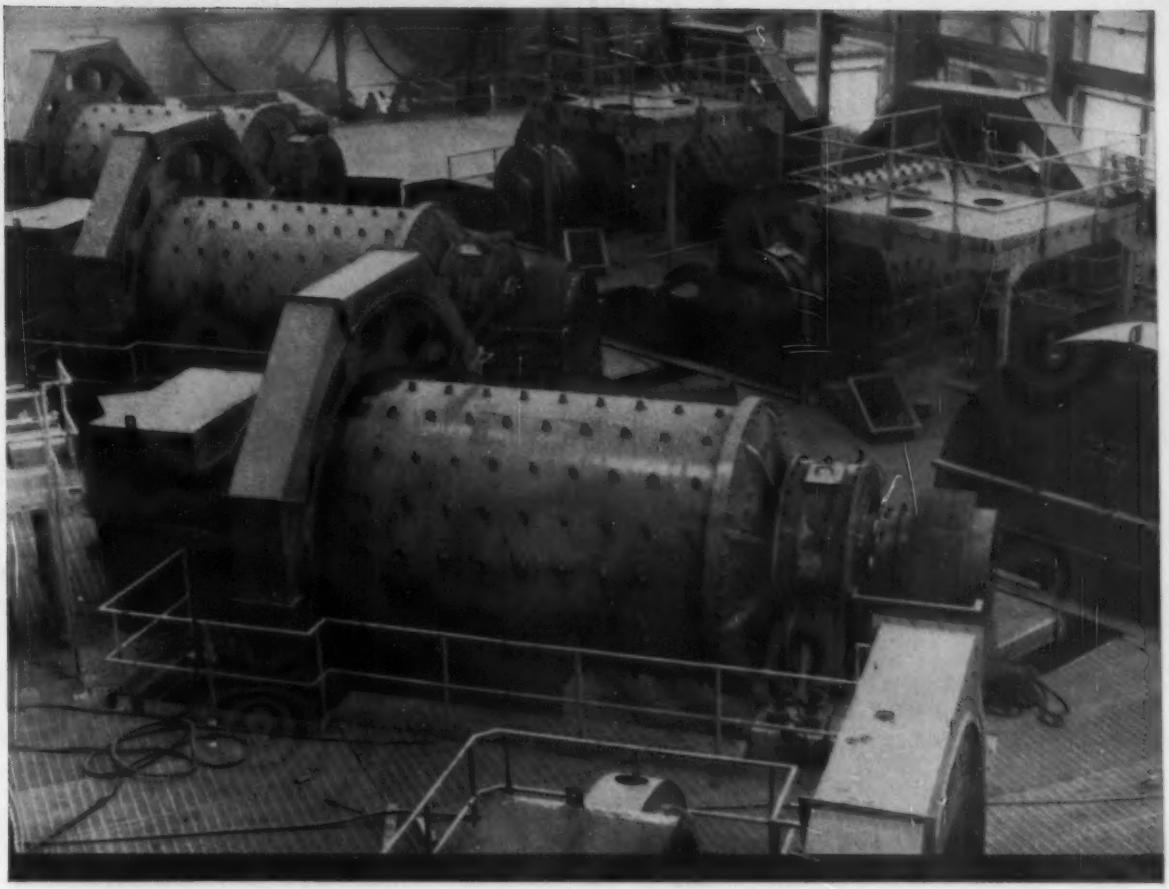
Operated in conjunction with the Adult Education Department of the Vancouver school board, the University of B.C. and the Provincial Department of Mines, the course is designed to train men in prospecting, and provide all interested persons with a knowledge of mineralogy, geology, mining methods, blow-pipe analysis, how to stake claims, and other subjects of practical value. Instruction is given in such a manner that it can readily be understood by the beginner who has no previous knowledge of mining.

Gilbert A. Labine, president of Gunner Uranium Mines Ltd., and the man who discovered Canada's first radium in 1930, is of the opinion that Canadian uranium industry will come into its own in a power-hungry world and Canada can confidently expect to be a leader in the peaceful uses of atomic energy.

Labine, who directed Canada's wartime uranium production for the Manhattan Project and now heads the country's largest producing uranium mine, made the observations while on vacation in Vancouver.

The period of over-supply, when government uranium-purchasing contracts run out in 1962 will be brief. It will also be competitive.

There "is no question" that there will be a shortage of uranium in the long term market outlook.



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- Cast steel or Meehanite heads
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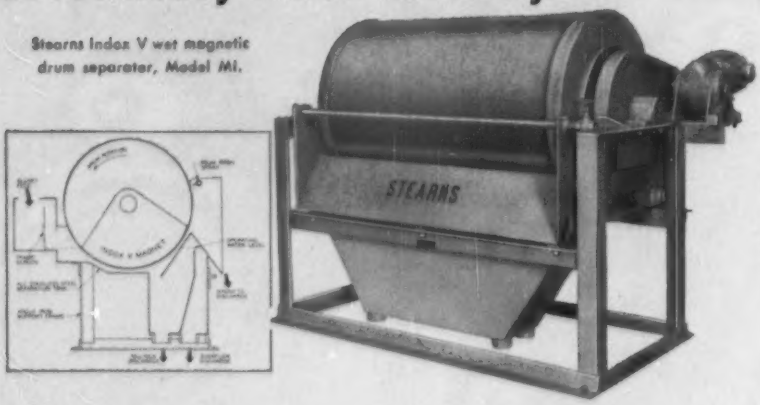
Stearns amazing new Indox V magnets boost heavy media recovery

Stearns Indox V wet magnetic drum separator, Model MI.



For cobbing or roughing iron-bearing ore

This new Stearns WPD heavy media separator is made with INDOX V — the amazing new ceramic material which obsoletes all other types of permanent magnets. INDOX V gives you a lighter-weight, lower-cost magnetic separator with a MORE EFFICIENT POLE STRUCTURE AND POWERFUL MAGNETIC FIELD. The results: increased efficiency, lower media recovery cost.

Indox V magnets cut costs

You get excellent mechanical performance with INDOX V permanent magnets. They assure a constant magnetic field with no power cost, no coils, no possibility of electrical failure within the magnet. Drum separator is an integral unit — no belt cost involved.

Big-capacity unit

The model MI, type WPD magnetic separator provides maximum media recovery at high-volume capacity. An important performance feature of the INDOX V WPD unit is its ability to discharge a magnetic concentrate of high specific gravity which, in coal preparation plants, permits plant operation without a densifier. The Stearns WPD incorporates a greater amount of tailing discharge area, and PRODUCES A CLEANER MAGNETIC CONCENTRATE than other wet drum separators. Stearns design provides for a minimum entrapment of non-magnetics in the magnetic concentrate.

Seven models — 30" dia. x 15" to 30" dia. x 72". Experience indicates a slurry feed of 8 gpm per inch of magnet width is a good figure for selection of separator size. See your Stearns representative for full details or write for Bulletin 2012D.

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B.C. *(Continued)*

Bralorne Pioneer Mines Ltd. reports a diamond drill hole at Pioneer has cut No. 27 vein at a depth of 700 ft vertically below all present workings. It intersected a 6-ft thickness of quartz carrying high gold values. Extent of the section is unknown. Additional drilling is under way to determine its length and depth. A second drill hole, aimed at cutting the original Pioneer main vein about 1,000 ft below all present workings is believed to be within 100 ft of its objective.

Franc R. Joubin, president, announced the appointment of John McMynn as general manager of the joint operation.

The company has made its first venture into eastern Canada exploration. It has joined with Tarbutt Mines Ltd., N. A. Timmins (1938) Ltd., C. H. Hopper and Franc R. Joubin in the development of a large group of claims in Montviel Twp, near the Mattagami district in Quebec. Anomalies of interest have been rechecked and three of them justify diamond drilling. A drilling contract has been let and surface trenching and sampling of mineralized outcrops is also under way.

Continental Mining Corp. Ltd. reports plans to amalgamate with Columbia Copperfields, owners of the Stemwinder mine at Phoenix. Proposed new name for company is Continental Consolidated Mines Ltd. The Stemwinder mine can be put into production without much delay. Continental has also acquired the Rawhide and War Eagle claims in the Phoenix area.

Empire Development Co. Ltd. shipped 20,000 tons of iron ore to Japan in August, making a total of 460,355 tons shipped on a contract calling for some 1.38-million tons for the steel mills of Japan. It is estimated the company has enough ore to complete the contract with Japanese interests over the next two years.

Consolidated Woodgreen Mines reports its mill, started in July, is gradually increasing output to full capacity of 1,000 tpd. It is estimated there is a reserve of 330,000 tons averaging 1.4% copper at the old 200 level and total available reserve of 400,000 tons.

A contract has been signed with the B.C. government by Silver Standard Mines Ltd. covering possible future iron ore production on its Moresby Island claims. B.C. will retain the rights to half the iron on the mineral claims and may, at its discretion, require the company to sell half on its output of iron ore or concentrates for processing in B.C. It also allows Silver Standard to mine a certain amount of the government's share of the ore.

Improved tonnage and grade of ore, and better prices for lead and zinc were responsible for Sheep Creek Mines Ltd. net profit of $222,553, compared with a loss of $21,306 the previous year, according to the annual report for the year ending May 31, 1959. Net concentrates production was $1,180,074,

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If there's an 9-yard mining shovel in your future, make it a Marion 181-M.

Here's a husky machine with the traditional strength, power and endurance of Marion mining shovels—plus small machine cycle time for an extra payoff every day.

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B.C. *(Continued)*

and net barite production was $7,026.

The annual report also revealed that the shareholders of Sheep Creek have been asked to authorize an increase in capital to help finance the company's new mine in Mexico. Sheep Creek expects to build a milling plant and have the silver-lead-zinc-copper property in production by 1960. It is estimated the project would cost about $1.5-million.

Noranda Exploration Co. Ltd. announced in its annual report that it has halted work on the property of Mt. Washington Copper Co. Ltd. near Courtenay on Vancouver Island, pending negotiation between Mt. Washington Copper and Esquimalt and Nanaimo Ry., a subsidiary of the Canadian Pacific Ry. Negotiations concern the base metal rights in Mt. Washington's mineral claims and because of the situation, work by Noranda has been limited to road construction this season.

Bethlehem Copper Corp. Ltd. has almost completed its ore sampling program at its Highland Valley property. Bulk sampling to date has confirmed that the grade in both the Jersey and East Jersey zones is higher than that shown by diamond drilling from the surface. H. H. Huestis reported the grade in the East Jersey zone will be in excess of 1.25% copper and the weighted average of the two zones will be between .85% and .90% copper. The 1959 program, designed to prove sufficient tonnage to justify construction of a mill, will bring total expenditure on exploration and development to $2.5-million.

B. C. Lightweight Aggregate Ltd. will soon be sending out 250 cubic yd of lightweight aggregate daily to British Columbia, Washington and Oregon, from its just-completed $800,000 shale crushing plant on Saturna Island, the first of its kind in the Pacific Northwest.

Kenneco Exploration (Western) Ltd. is proceeding with diamond drilling after three months preliminary investigation of an optioned Highland Valley property. Kenneco, a subsidiary of Kennecott Copper, has optioned 70 claims from Amador Highland Valley Coppers Ltd. and Minex Development Ltd.

The work will investigate several anomalies which cover areas of extensive rock alteration and low grade mineralization of the type that forms large porphyry-copper deposits.

A three year contract has been signed by Giant Nickel Mines Ltd. and Sumitomo Metal Mining Co. Ltd. of Japan for the sale of all nickel concentrates from the company's mine near Hope. First shipment will leave Vancouver early in 1960. Giant Nickel (owned 51% by Giant Mascot Mines Ltd., and 49% by Pacific Nickel Mines Ltd.) expects to complete its present concentrate contract with Sherritt-Gordon refinery at Fort Saskatchewan, Alberta, next January. Price the Japanese will pay is "somewhat higher" than the price paid by Sherritt-Gordon, freight expenses will be considerably reduced and the concentrates can be shipped with a 10% moisture content.

MANITOBA

Hudson Bay Mining & Smelting Co. reports net earnings for the first half of 1959 amounted to $4,401,388, compared with $2,740,169 for the same period last year. The company expects to get its two new mines at Snow Lake into production early in 1960. A 52-mile railway spur is being built and it is expected the two mines will provide 1,500 tpd shipping ore.

Sherritt Gordon Mines Ltd. reports profits for the first half of 1959 amounted to 10c per share compared with 15c per share earned in the first six months of 1958.

At Lynn Lake, a mill expansion program is being carried out which will raise the milling rate from 2,500 to 3,500 tpd and permit the treatment of lower grade ore. Ore reserves have increased since 1953 and now stand at 14.6-million tons averaging 0.90% nickel and 0.56% copper. The company has entered into contracts with North Rankin Nickel covering the purchase of 28-million lb of nickel concentrates, and

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PICKLED in a 4% brine solution!

CHOKED
in a tornado of abrasive dust!

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for weeks at 75° C below zero!

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in thick, sluggish mud!

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Thanks to exclusive Poxeal and Silco-Flex insulations, Super-Seal motors have shown endurances that even enclosed motors couldn't match. Results and reasons available from your A-C representative or distributor. Or write General Products Division, Milwaukee 1, Wisconsin

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Easy to use—drilling controls all grouped on back head for convenient operation.

Easy to move—lightweight aluminum alloy feed cylinder keeps drill weight down, production up . . . makes setup and moving easier.

Push-button bleed—located on "D" handle—releases air pressure in feed leg fast.

Built-in safety—exclusive, air-operated water gland automatically provides "water on, air on . . . air off, water off" drilling cycle.

Stays clean inside—constant air blowing through chuck end keeps water and cuttings from entering drill.

Hard-hitting drills—your choice of fast-acting 2½″ or 2⅝″ drills. Feed travels of 24″, 36″, 48″ or 60″.

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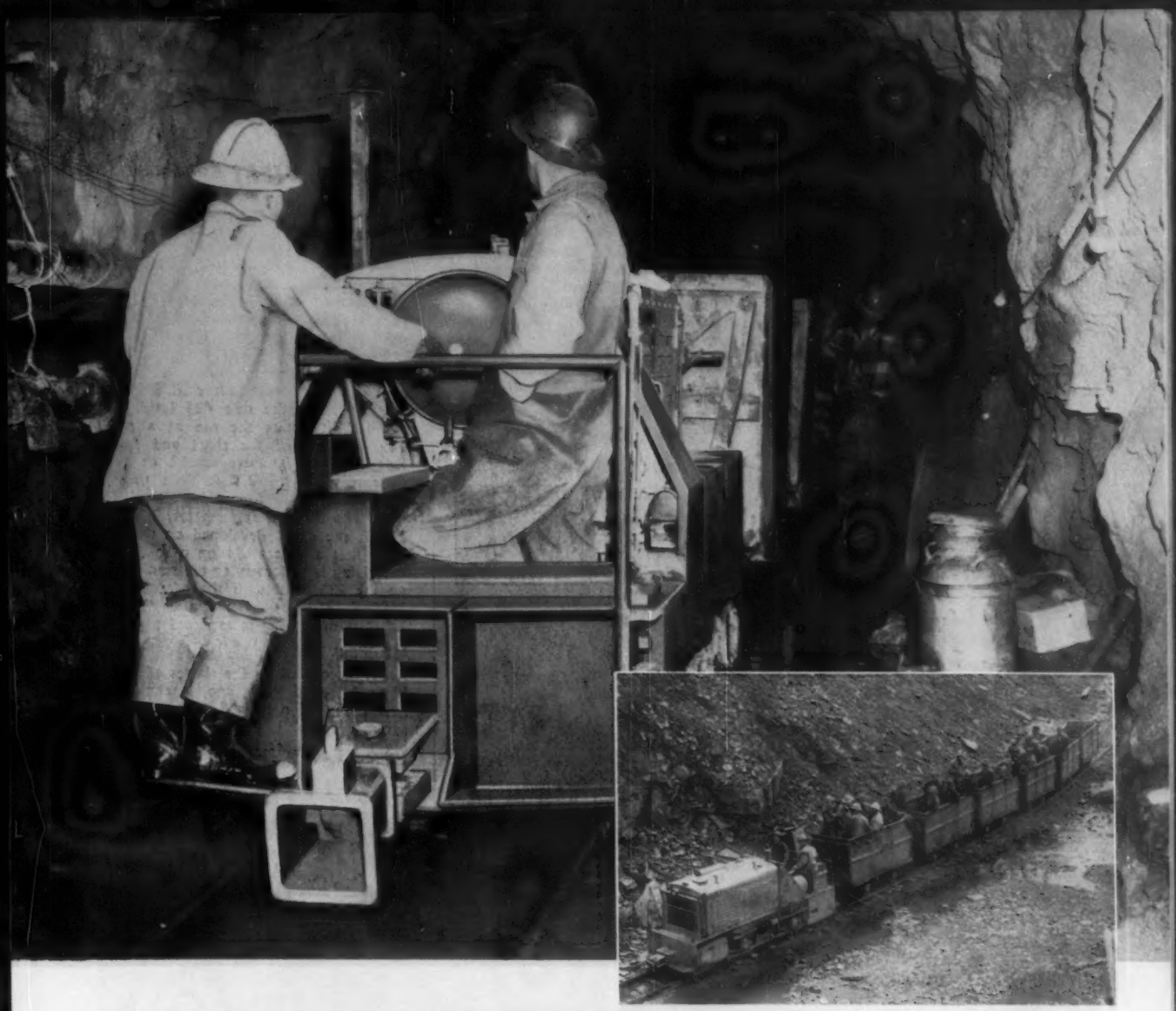

PLYMOUTH Mine-O-Motives help set new records at West Delaware Tunnel

A fleet of 17 Plymouth Mine-O-Motives, employed by joint venture contractors Drake-Grafe-Winston-Tecon-Conduit under Project Manager Clancey O'Dell, have helped to establish new hard-rock tunneling records of as high as 85 feet per day on the West Delaware Tunnel near Cannonsville, New York. Working around the clock since the summer of 1956, these Diesel-Powered mine locomotives have seen the most rugged service imaginable for mechanical equipment. Rough trackage, deep water, heavy loads of rock waste, all on a 24 hour schedule to push this 45 mile long tunnel deep through the Catskills for additional water to the New York City water system.

Used from the west portal and from several shafts on the western end of the tunnel, these 10 and 15 ton Diesel locomotives have proven their ruggedness and suitability for tunneling work. Plymouth exhaust conditioning equipment has maintained tunnel air at a high degree of purity. Easy accessibility of all parts speeds maintenance, keeps down time to a minimum. Torque-converter drive cushions shock loads, speeds up production, provides maximum power, and reduces operator fatigue.

For full information on Plymouth Mine-O-Motives and Locomotives, tailored to your exact haulage needs, contact The Plymouth Locomotive Works, Division of The Fate-Root-Heath Company, Dept. A-22, Plymouth, Ohio.

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PLYMOUTH LOCOMOTIVES in Progressive Industry throughout the world

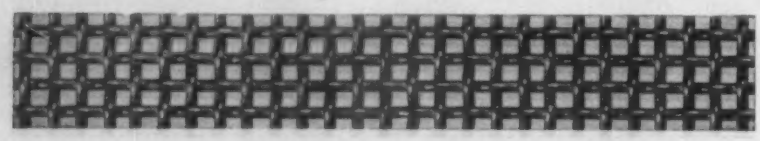
Manitoba *(Continued)*

with Giant Nickel Mines for 8,000 tons of nickel concentrate to be delivered at Fort Saskatchewan before June 1960.

San Antonio Gold Mines Ltd. reports it will proceed with the development of its subsidiary, Forty-Four Mines. Plans call for the sinking of a 1,000 ft winze and the opening up of six new levels. The winze, to be known as No. 5 shaft, will be collared on the 26th level (3864 ft). Deep drilling has indicated ore grade somewhat better than mine average. The company is milling 310 to 325 tpd and has sufficient tonnage to maintain the mill until the new mine opens up. The company is also active in outside exploration.

Stall Lake Mines reports recent drilling on its holdings adjoining the Hudson Bay Mining & Smelting Stall Lake property has returned encouraging values in copper and zinc. Six holes on the 'A' Zone averaged 4.8% copper, 3.14% zinc and low gold-silver values over a 10 ft width and 250 ft length. The company now has two drills working on the property to speed up the program.

Explorers Alliance is commencing a drilling program on its gold property at Herb Lake to test a zone where interesting gold values were reported in earlier surface work.



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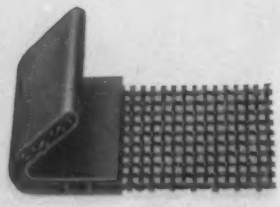

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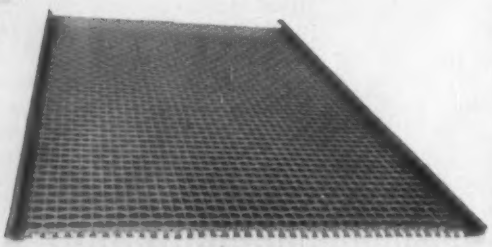

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NORTH WEST TERRITORIES

The shaft at Taurcanis mine has been completed to 675 ft and lateral work started on the two new levels. The development program includes 6,000 ft of lateral work and raising, and 7,000 ft of drilling. Construction of a two-story personnel building and lengthening of the air strip is underway.

Both north and south drift headings are in ore at the new 625 level. The south drift enters the ore at a point 289 ft south of the shaft and for a length of 75 ft averages .82 oz gold over a width of 2.4 ft. The present drift face contains considerable visible gold. The shoot is immediately below a 361 ft ore shoot developed on the 325 level that averages .84 oz over 4.8 ft.

Driving is underway to the south zone on the 325 level with the present face 2100 ft south of the shaft. Another 1,000 ft of driving is expected to reach the south zone.

Gold, discovered on the shores of Great Slave Lake 25 years ago, is causing a new flurry of activity in the area this summer and fall. Prospectors are looking for the mineral in greater numbers than at any time since 1945-47. The inflow was sparked by the re-discovery in July of gold, 250 miles northeast of Yellowknife by Consolidated Northland Mining Co. and North Goldcrest Mining Co. The gold was originally located, but not developed, in 1948. Consolidated Northland states that three visible veins of fine gold have been found. Currently, the company is trenching and drilling to 800 ft. According to federal northern affairs department officials, 320 claims were staked in the area in July and another 290 in August.

The officials added that an important factor in the resurgence of interest in the area is recent reductions in the cost of air freight. Another factor is that modern mining equipment can now be flown in, and a third is the spread of radio communication through the sub-Arctic northland in the last eight years.

Four gold mines currently operate in the Yellowknife area. They are Giant Yellowknife, Consolidated Mining & Smelting, Discovery Mines, and Ruth Mines.

Precise location of the discovery, which has not yet been assessed, is 60 miles north of McLeod Bay on the east arm of Great Slave Lake, and about 250 miles northeast of Yellowknife.

NEWFOUNDLAND

Advocate Mines is constructing a test plant at its asbestos property on Burlington Peninsula on the north coast. The plant is expected to be in operation by September of this year and is planned to mill 6,000 tons of ore. Development

When you're talking about a $162,000 dipper shovel, you've got to talk about the best rope for it

Talking about or working with, the same thing applies. Anything below Royal Blue's performance level is simply unrealistic. Like looking for a cut-price brain surgeon.

Even at $162,000, the cost of wire rope is important. That's why so-so ropes can cost you more in the long run, because so-so ropes are *short run*. Royal Blue, on the other hand, is built by America's oldest manufacturer of wire rope to last, to do the job without a whimper. Here's why.

Royal Blue is made from the toughest rope wire ever made—Type 1105—extra high-strength improved plow steel. This pedigree gives to the rope qualities that you can't find in any other rope: exceptional resistance to shock, abrasion, fatigue and impact. Add to these a flexibility that age cannot wither nor hustling fade and you've got a collection of characteristics that make Royal Blue the strongest rope you've ever used.

A $162,000 Dipper Shovel deserves the best and your Roebling Distributor has it . . . Royal Blue. Any inquiries about this high-born rope will be answered immediately by Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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Newfoundland *(Continued)*

headings are being driven from the West zone shaft to provide bulk samples. Drilling in the zone has confirmed about 10-million tons to the 500-ft horizon with grade better than previously estimated. Diamond drilling is continuing on the North zone, where an adit is being opened for bulk sampling.

Exploration has been renewed under direction of Frobisher Ltd. at the Pilley's Island copper-pyrite property in the Notre Dame Bay area. Initial work consists of geological mapping and other surface work.

ONTARIO

American Nepheline Ltd. has been granted an exploratory license of occupation covering 570,240 acres in the Cochrane District. The license was approved by the Ontario cabinet under the terms of an order-in-council and grants the right to explore for kaolin, fire clay, ball clay and silica sand in 11 full townships with the exception of a number of blocks of land that have already been leased as mining claims. The land in the Missinaibi River basin covers the townships of Habel, Mahoney, Amery, Hambly, McCausland, Burstall, McBrien, Garden, Wright, Acres and Kipling. The license was issued for a three-year term and calls for the expenditure by American Nepheline of at least $125,000 in exploration, metallurgical testing and market research.

American Nepheline has been engaged for several years in the production of nepheline syenite from its quarry in the Blue Mountains at Nephton, northeast of Peterborough. It is associated with Ventures Ltd. in a new exploration venture in northern Ontario. Both are Canadian companies operating principally on Canadian capital.

Hedman Mines Ltd. in Munro and Warden Twps., northern Ontario, has outlined by drilling what appears to be a large deposit of asbestos, reports J. J. Mangan, president and general manager of the firm. W. J. Wark, resident geological engineer calculates there are approximately 10-million tons of asbestos-bearing peridotite in sight. Drilling has indicated at least 100 ft of asbestos ore in the mineralized zone and is still in fiber at last report. Ultimate dimensions of the zone are not known.

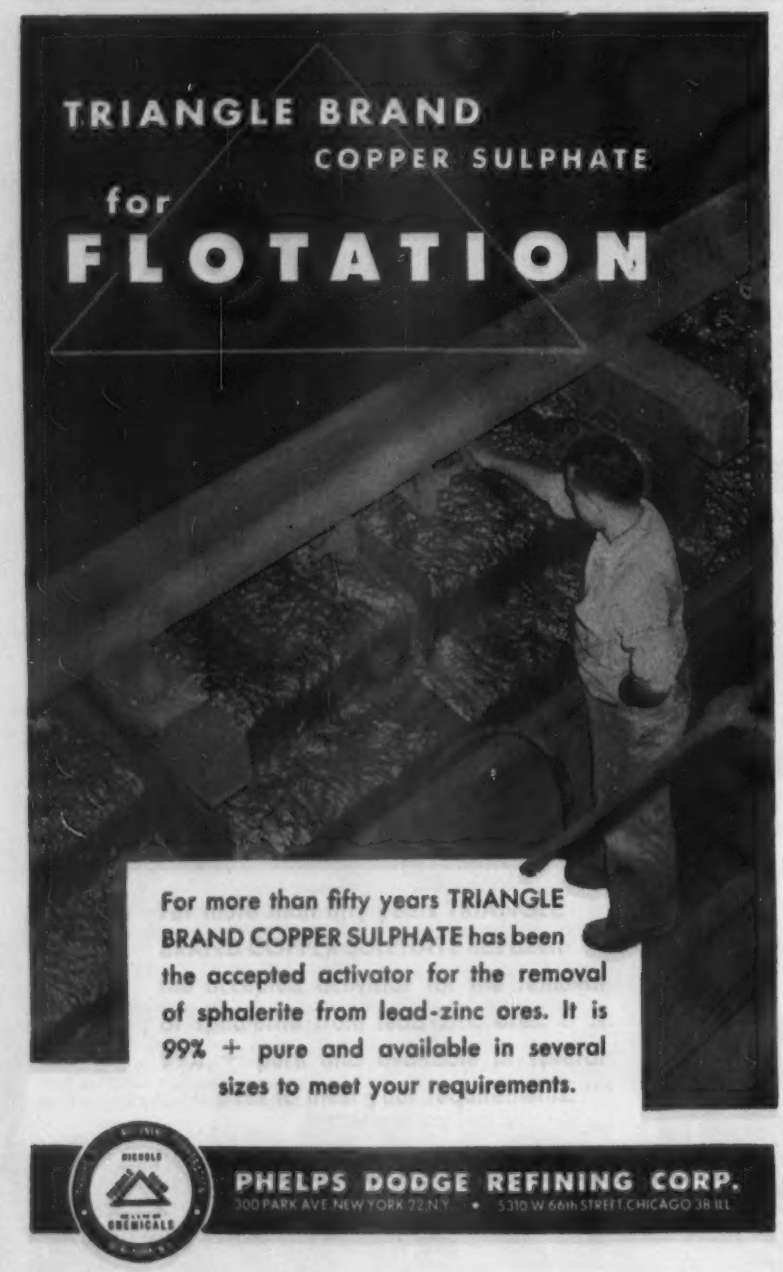
The Hogarth mine of Steep Rock Iron Mines, Ltd. has shipped a total of 10,173,958 tons from 1953 to the opening of the 1959 season.

Canadian Charleson Ltd. has set its 1959 shipping target at 170,000 tons of iron ore concentrates for its Steep Rock area project. This year operations started in May and are scheduled to continue into October. The property contains large deposits of low grade iron-bearing gravels, containing from 5% to 25% iron. The gravels are washed, screened and concentrated into a premium uniform product grading about 58% iron. As a by-product the plant turns out washed and screened gravels. At present the gravels are being stored at the property for future sale.

Campbell Red Lake Mines is continuing to establish new production records at its Red Lake area gold producing property. Output in the first half of the current year amounted to $2,763,449, up from $2,581,147 in the corresponding period of 1958. Average recovery of $21.47 per ton was the highest yet achieved. Currently, work is proceeding on deepening the shaft from the present 2240 level to 3240 ft to open seven new levels.

Ontario's 30 gold mines produced 1,331,794 oz gold and 194,346 oz silver, valued at $45,237,859, in the first half of this year. This compares with 1,345,182 oz gold and 220,777 oz silver, valued at $45,859,408 in the corresponding period of 1958. Tonnage milled amounted to 4,671,480 tons, against 4,675,262 tons in the first six months of 1958.

Jalore Mining Co., a wholly-owned subsidiary of Jones and Laughlin Steel Corp., is continuing a program of testing and engineering studies on its iron property in Boston Twp., some six miles southeast of Kirkland Lake. No decision has been made as yet on production.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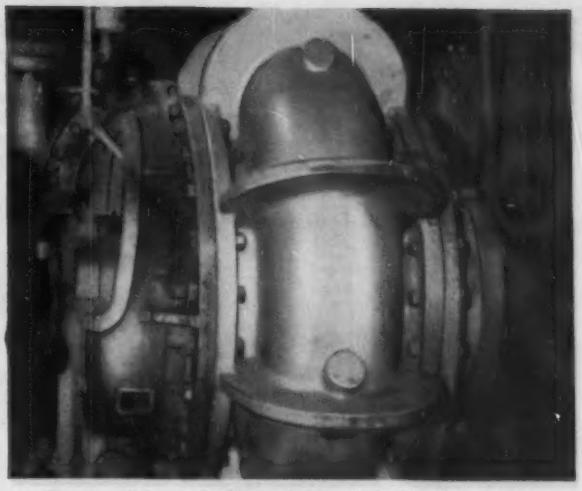
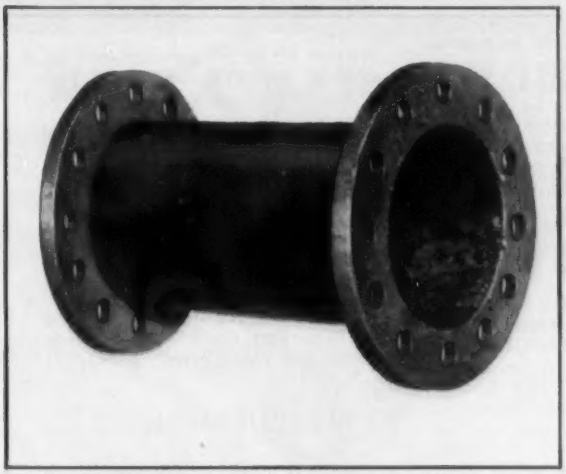
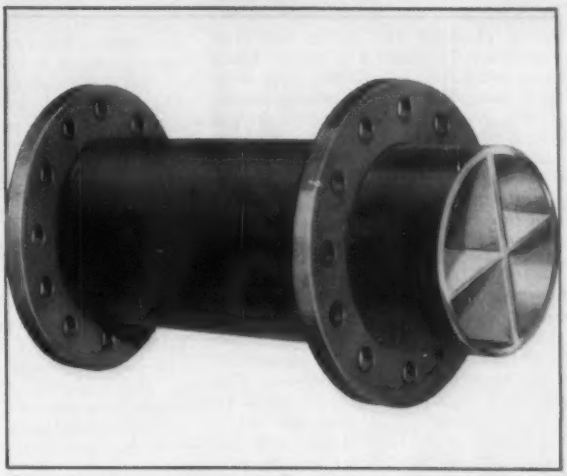
1. This thick slurry (28% solids) comes from a coal washing process half a mile away.



2. To stand its grinding action, this 2600 gpm pump is fitted with Ni-Hard impellers and casings.



3. So when fast-running slurry caused heavy wear in the suction-side piping of these pumps . . .



4. It was easy to answer the problem by inserting baffles and sleeves of Ni-Hard iron.

How Ni-Hard Castings Beat Wear Problem— Reduce Maintenance In Coal Washing System

One of the largest hydraulic refuse-handling systems relies on outstanding abrasion resistance of Ni-Hard iron to dispose of 160 tons per hour of tailings.

The Sunnyhill Coal Company in New Lexington, Ohio has one of the largest hydraulic refuse - handling systems in the coal industry . . . and with the help of Ni-Hard* nickel-chromium cast iron, it is one of the most efficient.

The system's three solids-handling pumps, built by Barrett-Haentjens & Co. of Hazelton, Pa., are well protected against swiftly moving streams of abrasive tailings. All impellers and casings are made of Ni-Hard iron, the outstanding alloy for abrasion protection.

Materials rejected in the coal washing process — rock, shale, sand and other waste — mixed with water, swirl through the pipelines at high speed. This once caused heavy wear in the suction line . . . until Barrett-Haentjens installed a cross-shaped baffle of Ni-Hard iron mounted in a Ni-Hard sleeve inside the regular cast iron pipe. Action of the baffle in curbing turbulence and the superior abrasion resistance of Ni-Hard iron combined to beat the wear and maintenance problems.

If you are experiencing severe wear in pumps and lines, and shutdowns for repairs are too frequent — it will pay you to consider long-wearing Ni-Hard cast iron for your operations.

Ni-Hard castings are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco.

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INCO NICKEL

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Ontario *(Continued)*

Currently bulk samples are being shipped out for metallurgical test work. In addition studies are being made on cost and availability of fuel, power, water, and other data.

Caland Ore Co. is maintaining schedule in preparation for initial production in 1960 at its large iron project on the Steep Rock iron range. It is expected that initial production will amount to some 750,000 tpy with gradual increase to 3-million tpy in 1969. Development of the Lime Point open pit mine and of the Falls Point underground mine is continuing. A 5-mile railway spur is being constructed to the property and is expected to be completed in plenty of time for next year's shipping season.

A diamond drilling campaign has been started by Lun-Echo Gold Mines to test thoroughly its original Manitouwadge area base metal prospect. Two machines are being used with a minimum of 20,000 ft planned. The group has been expanded to 78 claims with options taken on an additional 130 claims. First drilling is being done in the southern section of the property where early drilling picked up copper, zinc, lead and silver values. Testing will also be carried out in other sections of the property. A number of conductor zones have been outlined in geophysical work, one of which appears to line up with the zone in which values were obtained.

Anaconda Co. (Canada) Ltd., Canadian exploration arm of Anaconda Co., has taken up a total of 584 claims in the North Caribou Lake area, some 200 miles north of Sioux Lookout. The properties were acquired from the J. E. Ayrhart interests of Toronto for $150,000 with payments spread over a 4-year period. Anaconda has the right to purchase all or any part of the total at any time by payment of the above amount plus $5,000 for each claim retained. The claims were picked up following results of an aerial geophysical survey and indications of high gold, silver, and copper values on a discovery group, which is being retained by the Ayrhart interests.

Anaconda has started construction of a 100-ton pilot plant at its iron property near Nakina. The plant is expected to be completed by next winter. While no definite decision has been made as yet, it is understood that production will involve a plant of minimum capacity of 2-million tpy iron pellets, and possibly more than double the figure.

Hallnor Mines plans to deepen its inclined winze an additional 300 ft at its gold producing mine in the Porcupine area. This will open a vertical block of about 200 ft for further exploration. Drilling below the present bottom, or 23rd level, picked up a narrow quartz vein about 180 ft below the level, while drifting on the 23rd level has opened a length of 300 ft of better-than-mine-average grade across drift width.

North Coldstream Mines, formerly Coldstream Copper, has embarked on a program of shaft deepening, preparatory to resumption of production, at its copper property in the Shebandowan area. The shaft is being extended 650 ft to open four new levels, the deepest at 1400 ft. Work is also in progress on changes in the mill to increase efficiency of the 1,000-ton plant. In previous operations the deepest working level was at 800 ft.

Madsen Red Lake Gold Mines has completed shaft deepening at its gold producing property in the Red Lake area. The program carried the shaft to 3875 ft to open six new levels below the present bottom, or 17th level. Drives are now in progress on the 18th and 19th levels toward the ore zone some 1,000 ft distant. It is expected that ore will be reached on the new levels by year end.

QUEBEC

Steady progress is being made by Copper Rand Chibougamau in preparation for production in December of this year at its Chibougamau copper property. The mill, which will handle 1,500 tpd initially, and the permanent headframe are now under construction. Other surface buildings have all been completed. Drifting and crosscutting to open the main Eaton Bay zone have been completed to the bottom level at 1300 ft. Stope preparations are in progress on all levels.

Finding of new ore in the No. 1 mine area promises to give Malartic Gold Fields a new lease on life. The operation has been more or less on salvage for the past year or so. New findings, which have yet to be fully determined as to extent and grade, may well extend the operation beyond the middle of next year, the time at which it was previously estimated mining would cease. In the meantime, the company has lined up custom work from two other mines, and a possible third mine, in the area.

Aluminum Company of Canada will halt magnesium production at Arvida and henceforth obtain its metal from Dow Chemical Co. and Dominion Magnesium Ltd. "Economics of magnesium production" caused the move, according to Alcan, who will pay for the Dow magnesium with aluminum of equivalent market value.

Opemiska Explorers has reported a spectacular gold showing on its Lesperance Twp. property. Coarse visible gold was found in a 2-ft quartz lens exposed in trenching. The discovery is located in a shear zone, which has been trenched over a 95-ft length with width of the central section about 10 ft and of the ends about 4.5 ft. Additional exposures have been located in other sections of the property. Further stripping and sampling are being carried out prior to diamond drilling.

Shaft sinking is being considered for the Consolidated Vauze gold-copper-zinc-silver property in the Noranda area. Tentative plans call for a standard 3-compartment vertical opening to depth of about 800 ft, with one level at the 600 horizon. It is not expected that the work will start much before the end of the year, should final decision be made. Work at the property, which is being financed and directed by the Consolidated Zinc Corporation of Canada Ltd., is continuing.

Quebec Lithium Corp. has filed a $4,477,924.39 breach of contract suit in U.S. District Court in Minneapolis against Lithium Corp. of America. Lithium Corp. canceled its contract, dated March 5, for lithium concentrate with the Quebec company in August after announcing that it was consolidating its operations at Bessemer City, N.C.

An attorney for the Quebec company said that the complaint alleged that under the terms of the contract his client had more than 515,000 units of lithium concentrate still to be delivered. He said that at the delivery rate of 17,000 units a month, the contract would run until 1962.

Herbert W. Rogers, president of Lithium Corp. said the action was groundless but refused to comment further.

Quebec Cartier Mining Co., a U.S. Steel subsidiary, announced that it has arranged to borrow as much as $200-million from a group of 12 Canadian and U.S. banks to help finance the Lac Jeannine iron deposit. The credit would probably be used to assist in development of the 193-mile railroad, hydroelectric plant, open-pit mine, harbor and other facilities. The railroad is being built from Port Cartier, Que. to Lac Jeannine (see E&MJ, March, p 18).

SASKATCHEWAN

The shaft of Continental Potash Co. at Unity in western Saskatchewan, at 1675 ft when sinking operations ceased in 1958, is to be deepened this fall to its originally intended objective of 3300 ft to reach potash beds. F. S. Welters, company president, said necessary financing was coming from $475,000 received from sale of natural gas field holdings in the area to the Saskatchewan Power Corp. When the beds are reached, he said, planned production will be at an initial rate of 180,000 tpy to produce 112,000 tons of marketable output.

Sinking plans call for freezing the water-bearing horizons to a depth of 2050 ft, at which point the shaft will enter limestone.

Drilling at the iron ore claims of Interprovincial Steel Corp., Ltd., near Choiceland, 40 miles east of Prince Albert, has reached 2,000 ft to expose the top of the orebody. The company has a 5-hole program scheduled for completion by mid-November. Spudding began Aug. 21. Diamond coring will proceed through October.

The company has 65 claims in the area, adjacent to the 105-claim magnetite prospect on which the Kelsey Lake Development Co. holds a two-year work purchase option.

Can your loader "lift its lip" and duplicate dozer action? No?

Then trade it off without delay! Because you'll miss money-making opportunities right and left without this big-capacity 4-in-1 action. And you have positive "radius control" of dozing depth; plus strength for hard digging! Here, the new International Drott TD-20 4-in-1 is dozing heavy gumbo material like a full-size blade!

Can your loader grade and strip like a carry-type scraper? No?

Then consider what extra service—and extra-valuable service you would have—with versatile scraper-like action at your fingertips with a moderately-priced 4-in-1! This TD-20 4-in-1 is stripping sticky clay. It can also grade or spread materials with similar accuracy.

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Can your loader "bottom-dump" and handle sticky materials? No?

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IN LATIN AMERICA

BOLIVIA

A number of top Bolivian nationalized mining officials in London have "satisfactorily negotiated" a private loan of £2-million.

The loan, according to local officials, is designed for the purchase of material and equipment "badly needed" in the operations of "Corporación Minera de Bolivia" (Mining Corporation of Bolivia).

CHILE

Robert L. Garner, president of the International Finance Corp. (IFC), announced that the corporation has agreed to invest an aditional $900,000 in Empresa Minera de Mantos Blancos, S.A., a Chilean corporation, which has under construction a copper mining and smelting project in the Antofagasta region of northern Chile. Mantos Blancos is controlled by Empresas Sudamericanas Consolidadas, S.A., a Panamanian corporation holding the mining, industrial and commercial interests of Dr. Mauricio Hochschild and associates.

In August 1957, IFC agreed to invest $2.2-million in the new company, which is opening a new copper mine and introducing a new metallurgical process for refining copper. The original project was designed for processing 2,000 tpd. The additional IFC investment of $900,000 is part of the financing required to increase the processing capacity to 3,000 tpd.

It is expected that the increased capacity will result in a substantial reduction in the company's cost of producing refined copper.

The total cost of the project is $18.6-million, of which $5.8-million is related to the expansion. Of this latter amount, $2.9-million will be invested by the Hochschild group and the balance by IFC, together with Chemical International Finance Ltd., $1.2-million; Bank of America, $600,000; and $200,000 in suppliers' credits.

CORFO (Chilean equivalent of RFC) will build a 50 tpd flotation mill at the northern port of Taltal which, some 40 years ago, was one of Chile's most important nitrate ports.

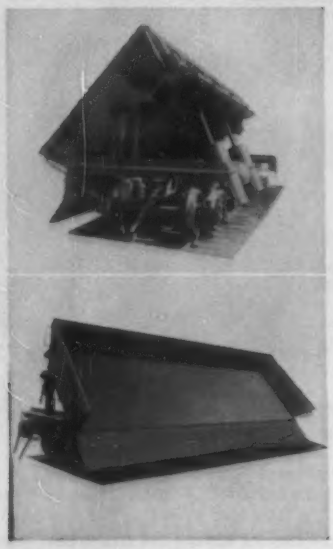
Potrerillos, the old copper mine which started producing in 1925 for Andes Copper Mining Co., an Anaconda subsidiary, closed down this year after 34 years of almost continuous production. From 1925 until June of this year, Potrerillos produced 3,534-billion lb of copper. In order to pay for its cost of production in Chile, Andes Copper Mining Co. had to return to Chile $123.25-million and pay to the Chilian government taxes that amounted to $53.7-million. Towards the end of its operations, grade had decreased to 0.7% copper from 1.53% when production started. The mine, which was originally drilled by William Braden, has now been replaced by El Salvador whose new mill started operating May 1 of this year (See May E&MJ, p. 118). It is expected that El Salvador mill will work at full capacity by Nov. 1st. Official inauguration of the mine, the newest of the copper porphyries, will take place in November.

Armco International Corp. has organized a Chilean subsidiary with a capital of U.S. $2.4-million to supply all of Chile's mills with grinding balls. The works will be constructed near Huachipato, located near a steel mill. Armco's subsidiary expects to produce, during its first year, 18,000 metric tons of balls. The quantity will be increased within five years to 25,000 metric tons.

Andacollo Mining Co. Ltd., headquartered at Toronto, Ont., has acquired the San Juan copper mine in Chile and has started shipments to the Llayllay mill. The company also recently brought the Andacollo mine in the Putaende region into production. End product from both mines is a 35 to 50% copper concentrate. Andacollo Mining has also reported a large strike in Peru. (See below)

PERU

Panamerican Commodities S.A., of Lima, owners of the Acari iron mine



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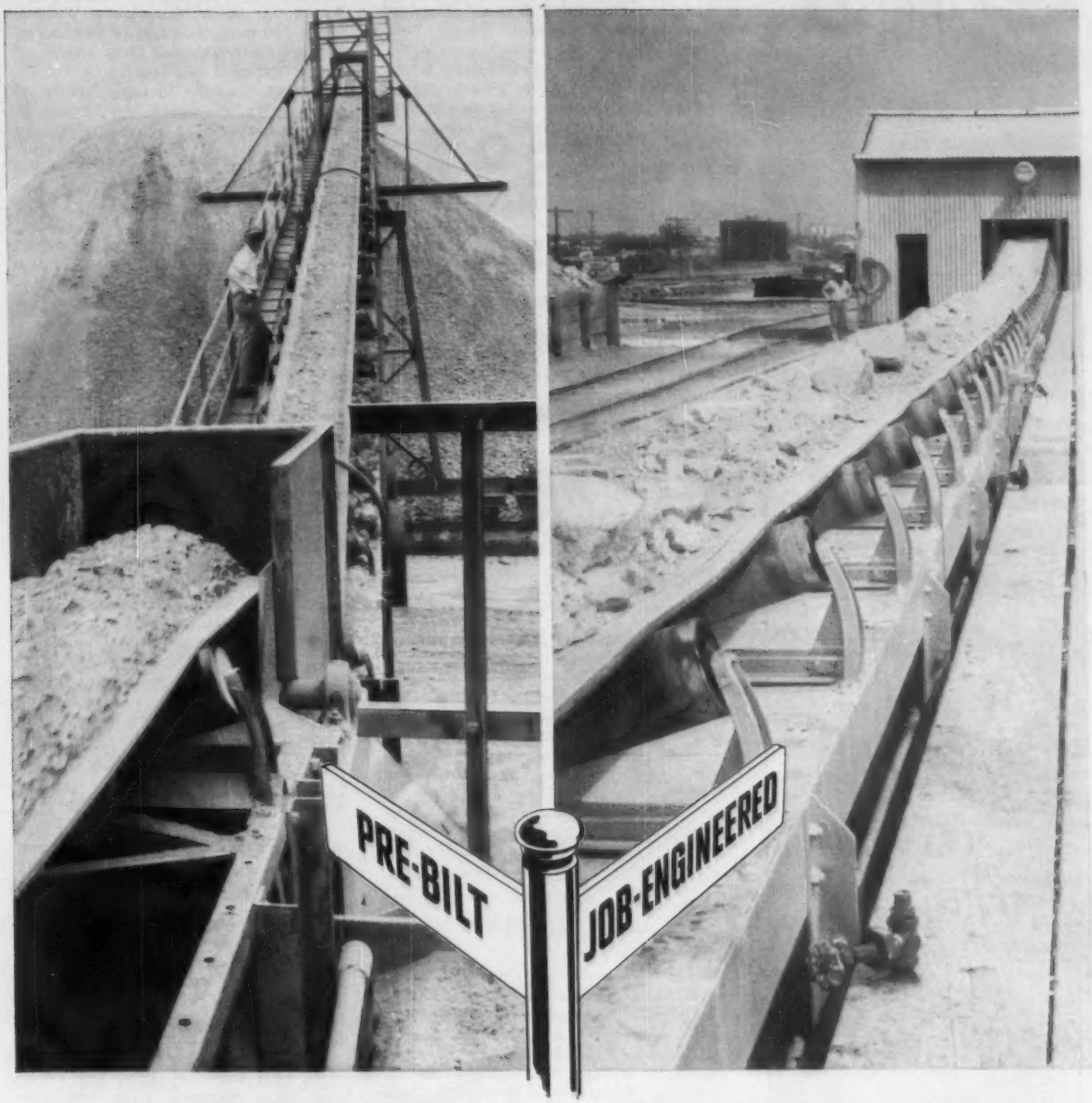

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Up or down—forward or back—tilt! At the touch of a lever. This is the comfort of the contour seat in your Autocar cab. It's just one more quality characteristic that makes Autocar the world's finest heavy hauler.

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Peru *(Continued)*

(See April E&MJ, p. 129), south of Lima, have received U.S. $4-million as an advance payment on iron ore from the Ore Marketing Corp., S.A., of Panama. Ore Marketing is a subsidiary of the World Commerce Corp., New York.

The loan, which is still subject to approval by the Peruvian government, is in the form of an advance payment on iron ore shipments and is to be used by Acari to complete the development of the property and for working capital. Under the terms of the agreement, which have not yet been made public, Acari will ship Ore Marketing a minimum of 450,000 tpy iron ore. Ore Marketing Corp. is also operating the Santa Barbara iron mine in Chile.

First shipment of ore from Acari was made in late August through the port of San Juan. The shipment of 23,800 tons was consigned to the Bethlehem Steel Co. which has a contract with Acari for the purchase of about 150,000 tpy iron ore. A second shipment of 13,500 tons, consigned to Armco, is now being loaded at San Juan.

Development of the Acari mine was started in 1958 by Wells Overseas Ltd., Toronto, Canada, which is in charge of placing the mine in operation, mining and hauling the ore to the port of San Juan. Financing for the development work was made by the American Overseas Finance Co., of New York.

Andacollo Mining Co. Ltd. of Toronto has reported results of preliminary work on their Cerro Landa copper property. According to Howard Steven Strouth, president of Andacollo, the company has proven, at an expense of $150,000, several hundred thousand tons of 6% and better copper in an enriched zone and a possible orebody of many millions of tons averaging better than 3%. Cerro Landa has a surface extension of some 12 sq miles and an additional 18 sq miles have been staked, he said.

FRENCH GUIANA

Kaiser Aluminum & Chemical Corp. and Bureau Minier Guyanais (BMG), a French State corporation, have formed an organization known as the Societe Guyanaise de Bauxite to develop bauxite deposits in the Kaw mountains of Guiana. The new organization will explore and possibly exploit deposits estimated to contain 70-million tons of bauxite. The board of directors of BMG reportedly signed final papers in Paris on June 16, 1959.

The deposits lie in a series of discontinuous pockets that stretch southeast from Roura, near Cayenne, toward Kaw and Guisambourg. Transportation will be via the Mahury River. The nearest deposits are about four miles from the river, and the most distant are 30 miles away.

A four-man Kaiser engineering team was in French Guiana checking the grade of ore and the relative cost of moving it to an alumina plant.

IN AUSTRALIA

Reynolds Pacific Mines (Pty.) Ltd. is conducting a survey of a 45-sq mile bauxite area, which the company has leased in South Gippsland, Victoria, about 100 miles southeast of Melbourne. Exploration is expected to be completed within the next two years.

According to the Victoria department of mines, a previous survey of part of the area revealed a proved reserve of 700,000 tons of high grade bauxite, ranging from 8 to 15 ft in thickness and averaging about 52% alumina and 7.6% silica. The hydrated aluminum mineral has been identified as gibbsite. The bauxite fills irregularly shaped erosion hollows in an old basalt erosional surface and is covered by sands, clays and lignites, with a thickness ration of overburden to bauxite of about 4:1.

The Australian Mineral Industries' Research Assoc. has been formed by major Australian mining, metallurgical and chemical companies including those controlled or partly owned by foreign interests. The new body is to develop new methods and processes for exploration, extraction and use of minerals and will be of special interest to smaller companies unable to afford research of their own.

It is understood that the new Australian body will be in close contact with similar organizations abroad. At a later stage Australia may sponsor an international association of bodies established for encouragement of research in metal and mineral industries.

IN THE PHILIPPINES

Philex Mining Co. established a new record in July, milling 47,000 tons and producing 1,010 tons of 25.7% copper concentrates with 1.1 oz gold per ton. Gross value was estimated at $233,000. Henry A. Brimo is president and George T. Scholey is general manager of the mine. Benguet Exploration Co., under the same management, operates a 50-ton mill in Mountain Province. Results have indicated that refractory high grade gold ores can be profitably treated even on a small scale basis. In July, 364 oz of gold were recovered from 949 tons milled, averaging 0.38 oz per ton. Because of premiums on the gold price in the open market the ore was worth about $26 per ton.

Atlas Consolidated reported improvement in July over June. In 30-milling days the mill at Toledo treated 319,288 tons of 0.64% copper during the month, compared with 302,868 tons of 0.59% copper milled in June. Copper content of concentrates was estimated at 3,683,000 lb, an increase of 518,000 lb over June. Shipments from the Mati iron mine, controlled by the same company, totalled 15,700 tons of sinter feed valued at $181,000.

HOW MARCY EXPERIENCE

WITH 2-STAGE GRINDING

Increases tonnage at lower cost

Mine and Smelter has specialized in the design, manufacture and application of Marcy Mills since 1915. The extensive research and experience during this time has resulted in many refinements in the grinding process. One of the most significant developments is 2-stage grinding.

Experience has proved two successful ways of using Marcy Open End Rod Mills for 2-stage grinding...

1. By addition of a grinding stage

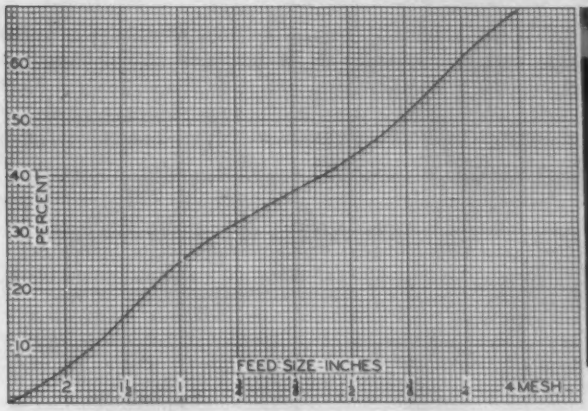
Adding Marcy Open End Rod Mills between existing crushing and grinding circuits...

- Permits larger size crusher discharge, thus greatly increases crushing capacity
- Rod mill can take 1" feed and produce a higher percentage of finished product than crusher
- Rod mill provides finer feed for ball mills, increasing their capacity
- Permits recovery of liberated mineral at coarser size

2. By replacing fine crushing

Replacing fine crushing with Marcy Open End Rod Mills gives all the advantages listed under No. 1, in addition to eliminating the high operating and maintenance costs of complex circuits of crushers, rolls, screens, elevators, etc.

Operating experience has proved that use of Marcy Open End Rod Mills for 2-stage grinding will increase tonnage at lower overall cost per ton



This graph shows increase in mill capacity with decrease in size of feed. For example if a rod mill was used to decrease ball mill feed from 1" to 4 mesh the ball mill capacity would be increased 45%.

This large copper company installed a 9½' x 12' Marcy Open End Rod Mill in parallel with its 2-stage roll-screen circuit. As a result of this test 17 Marcy Rod Mills were installed to replace all roll-screen circuits. Rod Mill feed is 1½" hard ore; grind is to 4% + 10 mesh; tonnage up to 2700 tons per day, each mill. They reduced costs and improved operating conditions.

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SALES AGENTS in Peru, Chile, Philippine Islands, Japan,-New York City (for Continental Europe) and in principal cities of the U.S.

Philippines *(Continued)*

Surigao Consolidated, is threatened with suspension of mining operations. Practically all accessible high grade ore above the 900 level has been extracted. Plans made earlier in the year to unwater the mine to the 1,000 and 1100 levels have had to be abandoned because a large volume of water had been dammed above resulting in dangerous working conditions in badly caved tunnels. However, the company has conducted an energetic prospecting campaign.

An iron ore deposit in Zamboanga del Sur has been extensively drilled. On the basis of drilling, ore reserves are estimated to exceed 5-million tons. Engineers are surveying right-of-way for a tram line to tidewater from the mine. The company is also exploring a copper property about 25 km north of the iron deposit. Three diamond drills are at work. At Guimaras Island several interesting copper veins have been exposed and drifting is going on. J. B. Harrison is general superintendent of Surigao Cons., and H. E. Heide is consulting engineer.

The Sipalay Copper Mine, third largest copper mine in P.I. produced 33 tons of molybdenum concentrates in July as by-products from milling its copper ore. This was the first time molybdenum has been produced in the Philippines.

The Philippine government will permit continuation of the export barter system which has resulted in a substantial increase in the production of the principal nonferrous mines which jumped 48% during the January-May period of 1959 over 1958. The barter trade law permits the sale of selected commodities abroad against payment in goods rather than money. The swapping arrangements have proven highly profitable because regular imports are restricted by licensing controls.

Lepanto Consolidated milled 38,400 tons of 3.2% copper-gold ore in July. Concentrates were estimated to contain 2,388,000 lb of copper and 3,502 oz of gold.

Consolidated Mines shipped 39,000 tons of refractory grade chrome ore in July valued at $800,000.

Above photo courtesy Wairton Steel Co.

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IN AFRICA

Rhodesian Selection Trust has announced plans for developing the orebody at Chibuluma West, situated only about 1½ miles from the group's other mine at Chibuluma. It is estimated to contain some 2-million tons of ore assaying 4.81% copper. Production is expected to commence in 1963.

Bancroft, the Copperbelt mine that restarted production this year after a series of troubles, discloses in a special report that 406,674 short tons of ore was milled during the three months ended June. The finished production amounted to 12,166 long tons of copper. Tonnage milled in June was 112,399 short tons, which is in harmony with production plans which provide for a gradual stepping up of the milling rate to 150,000 tons a month in the last quarter of this year.

The value of minerals produced in Northern Rhodesia during the first four months of 1959 was £42.8-million ($119.8-million). This is an increase of about 40% over the comparable figure of £27.4-million ($76.72-million) recorded in 1958. The increase was due largely to the rise in both the production and the price of copper.

Total production by Transvaal and Orange Free State goldmines fell from the July record of 1,749,382 oz to 1,735,150 oz in August. August was a shorter working month for some mines. The chamber of mines monthly analysis shows that the value of the total output that month was £21,631,536 ($60,568,300). This represents a fall of £177,426 ($496,792) compared with the July value.

The value of mineral production in Southern Rhodesia during May was £2,081,221 ($5,827,430), which is an improvement on the April figure of some £19,000 ($53,200).

A Swedish steel company is reported to be interested in the large deposits of

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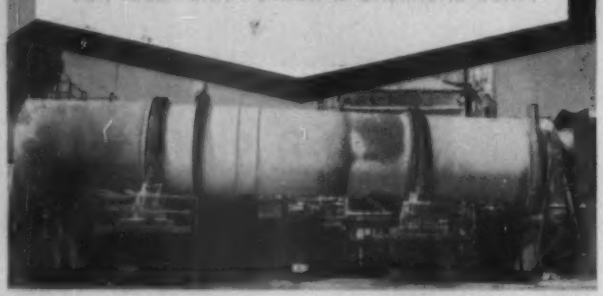

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Africa *(Continued)*

iron ore known to exist within a radius of 90 miles of Lusaka, Northern Rhodesia. The concern is believed to be particularly interested in a deposit at Sanje, some 14 miles west of Lusaka, which may contain from 3-million to 10-million tons of ore with more than 66% iron.

An air survey to locate and assess the mineral deposits of Nyasaland in the central African federation has begun. It will cover 2,100 sq miles of the southern and central provinces from Blantyre in the South to Ncheu in the North, and from Zomba in the East to Neno in the West. It will indicate the presence of iron ore and radioactive minerals. Some £5,000 ($12,000) towards the cost of the survey is being contributed by the British AEA.

Satisfactory values have been revealed in one of two deflections made in the borehole drilled south of the No. 1. shaft of Free State Geduld, one of the Anglo American gold mines. The first deflection produced an incomplete core recovery and yielded 876 in.-dwts. The complete core from the second deflection gave values equivalent to 1.690 in.-dwts. The second deflection emphasizes the consistency of the reef underlying Free State Geduld. The reef was intersected at 4460 ft.

Orange Free State mines produced a quarter of the total gold production of the Union in 1958, Sidney Spiro, chairman of the Free State mining companies of the Anglo American group, announced recently. The day is not far off when the Free State will produce half South Africa's gold output, he said. He estimates that nearly £300-million ($840-million) has been invested in the gold fields of the Orange Free State—almost all of it since the mining houses started drilling extensively after the war.

IN THE FAR EAST

INDIA

A 74-car ore train pulled by four diesel locomotives recently hauled 6,500 tons of iron ore for a major steel producer in India. The South-Eastern Ry. train made the 164-mile trip in 13 hours and 45 minutes. The locomotives were recently imported from the U.S. Close cooperation was maintained between the locomotive engineers by radio-telephones specially installed on the train. It was reported that the flow of raw materials to steel plants in the public and private sectors of India has more than doubled since last year. By 1961 the South-Eastern Ry. is expected to haul nearly 4,000 carloads of raw materials and finished products every 24 hours for the steel plants alone.

Value of mineral production in India

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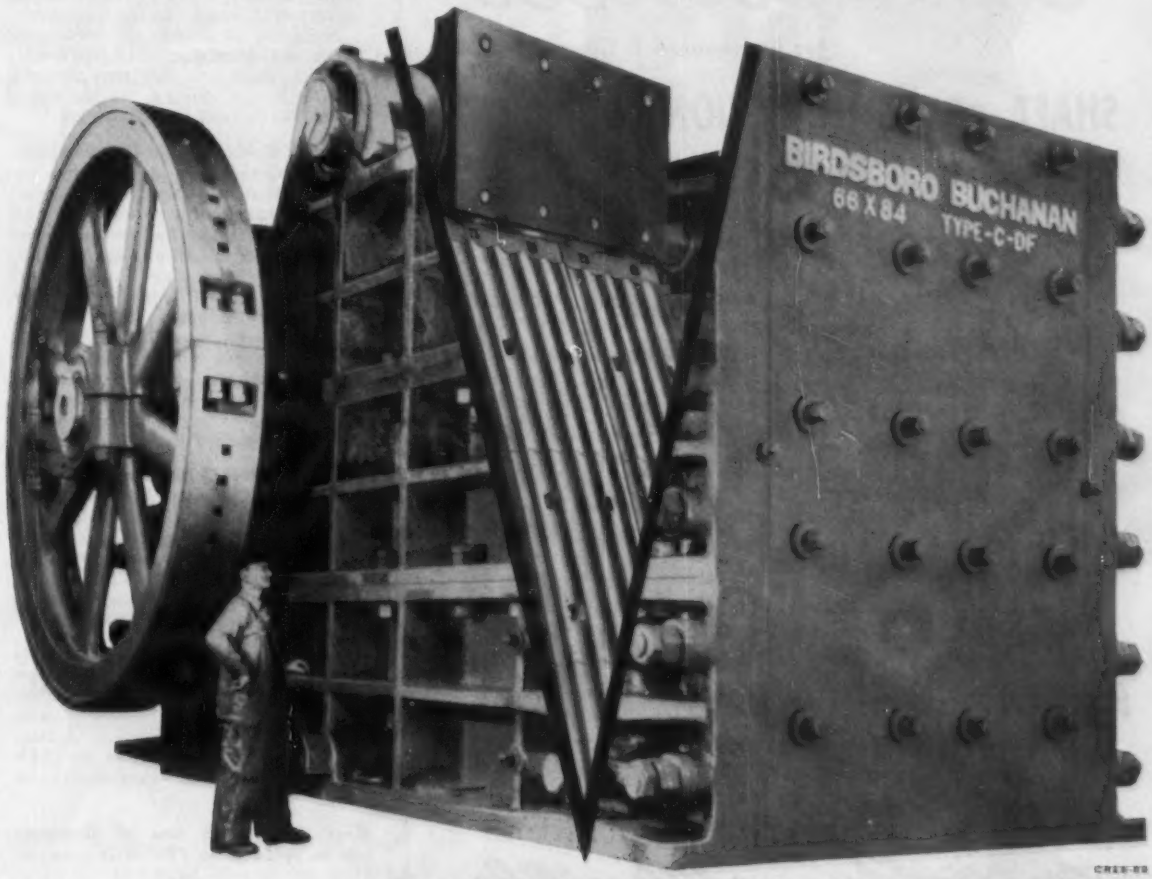

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India *(Continued)*

during the last 10 years has nearly doubled, according to the latest report by the Indian Bureau of Mines. The 1957 value was Rupees 1,237,000,000 ($259,770,000), representing an increase of 19% over that of 1956. Of the figure, production of metallic minerals accounted for R287-million ($6,127-million), and non-metallic minerals for R119-million ($24.99-million).

JAPAN

Sumitomo Machinery Co. Ltd., Osaka, has signed a technical assistance contract with Koppers Co. of Pittsburgh. The agreement covers information on the design and construction of sintering plants for Japan and southeast Asia, India and Latin America.

KOREA

Chemical processing facilities have been completed recently at the Sangdong mine in Hangwon Province by the government-owned Korea Tungsten Mining Co., it is reported. The Sangdong mine is one of the largest tungsten mines in the world. The new facilities will permit a higher recovery of tungsten concentrate, and, in addition, 100,000 tons of table tailings accumulated from past operations can be processed. The present concentrate grade averages 65 to 75% WO_3.

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IN EUROPE

Output of kali (potash) in the German Democratic Republic amounted to 753,-100 metric tons—3.2% above the planned amount, 1.8% above the output of the identical period of 1958. The East German potash mining business—fully in the hand of the state—has achieved an output in excess of 24,100 metric tons.

East Germany's 1959 potash (K_2O) export amounted to 1-million metric tons, shipped to 43 countries. This makes East Germany the world's largest potash exporter. Further efforts to market East German potash abroad may be expected since an output increase of 38% has been planned for the next seven years; output is to reach 2.12-million metric tons by 1965, exports to rise accordingly.

Processing of potash will concentrate on the output of granulated free-flowing material, since it is this type which is most in foreign demand, the DDR REVUE states.

Near St. Egidien in the Erz Mountains of East Germany, geologists have uncovered what promises to be Europe's largest nickel deposit. Already, the East German government has prepared plans for the erection of a large smelting plant and refinery close to the railway line running from Dresden to Glauchau.

Preliminary estimates show that for the time being, at least, the volume of nickel recovered will be sufficient to meet East German domestic requirements. Within two years, the plant is expected to be producing enough refined nickel to allow substantial exports.

The first West German uranium mine was to start operations in October near Ellweiler (Rhineland-Palatinate). Mining concession was acquired by Gewerkschaft Brunhilde last year. Initial daily output is expected to amount to 50 tpd. It is hoped that the yield will amount to about 1 tpm uranium metal.

During the first half of 1959 Italy exported 395.3 metric tons of mercury metal for a value of $2.3-million compared to 162.4 metric tons for a value of $1.08-million from January to June of 1958. Figures were given by AEF (Agenzia Economica Finanziaria) of Rome.

More than 70,000 tons of aluminum will be produced in 1965 it is reported. Most of it will be based on local aluminum oxide. The production of the oxide which previously Poland bought abroad will be started next year by a large raw material plant soon to be constructed at Gorka in the Cracow Voivodship. Bauxite slates and calcium available in large quantities in Lower Silesia will be the raw material.

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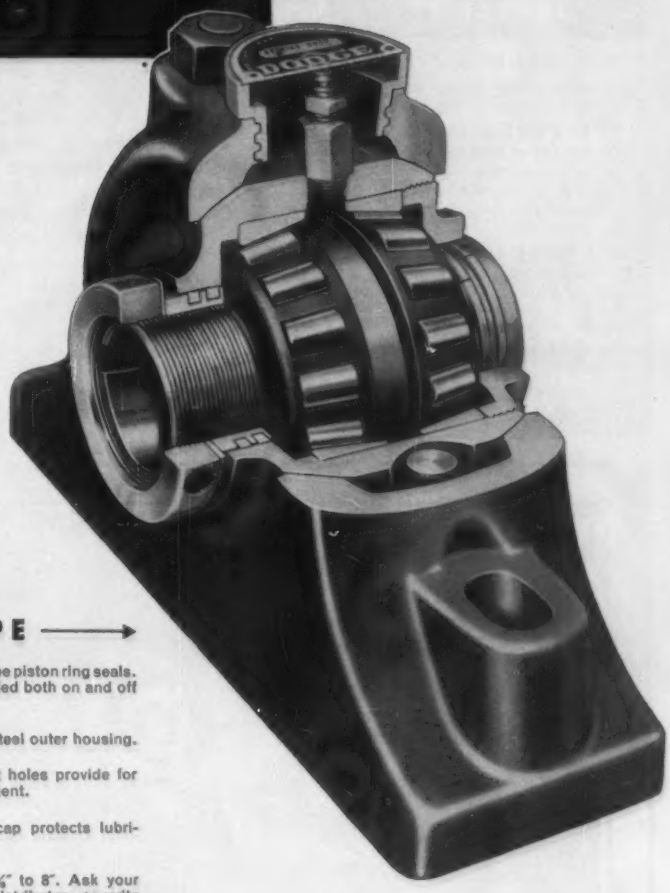

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Indian ferromanganese

(Continued from p 113)

During the period 1952 to 1957, years of high production rates were followed by years of relatively low output, suggesting carryover stocks. Before 1958, ferromanganese was produced in blast furnaces, but the present output is almost entirely from electric furnaces. Tata Iron & Steel Co. is still the largest producer (20,000 tons in 1958), and the next is Ferro Alloys Corp. (12,500 tons in 1958). Statistics on ferromanganese consumption are not available, but it is estimated to average 20,000 to 25,000 long tons per year at present. Consumption is expected to increase to 60,000 tpy when the 6-million ton steel capacity is achieved in 1960-61.

India has been an importer of ferromanganese because past production has been somewhat less than domestic requirements. Ferromanganese imports are not always listed separately in India's trade statistics. In some years, they are included in an over-all category of ferroalloys. Imports in long tons of all ferroalloys for fiscal years 1949-50 and 1952-53 were respectively 2,363, 2,406, 2,538 and 1,293.

Ferromanganese imports are shown in tabulation:

Imports of Ferromanganese into India

Year	Long tons	Year	Long tons
1953-54	3,447	1957	275
1954-55	3,567	1958	200
1955-56	287		

Ferromanganese made in the blast furnace in India was unacceptable to export markets because of its high phosphorus content. However, the industry hopes to find a market for the 100,000 tpy of electric-furnace ferromanganese which India plans to produce in excess of requirements. In 1958, India shipped 10,553 long tons, of which the U.S. received 6,556, Belgium 1,000, Greece 2,000, and Canada 997. In contrast to regular commercial imports, any ferromanganese delivered under the U.S.-Indian barter agreement will go into the supplemental stockpile.

Detailed data on production cost of ferromanganese in India are not available. Existing information indicates that, except for the plant of the Mysore Iron & Steel Works, the cost may be about $160 per long ton. Certain observers feel that with prevailing U.S. prices of standard grade ferromanganese, the Indian producers should be able to export their output at a profit. Costs of labor and raw materials per ton of ferromanganese are less than in the U.S., but the power cost is higher—0.9 to 1c (U.S.) per kwh for thermal and 0.75c for hydroelectric power.

Although the plants are located near manganese mines, in some cases local ore may have to be supplemented by purchase of low-phosphorus ore from mines in the Nagpur area. The plants at Joda and Garivadi are about 100 miles from hydroelectric power plants. The thermal plant supplying electric power to furnaces in Tumsar and Kamptee has direct rail connections with the Pench Valley coalfield 100 miles to the north and with the Chanda coal field 90 miles to the south.

Rudy McInturff, Master Mechanic in charge of 27 machines for Cascade Eastern Timber Co., Warm Springs Indian Reservation, Oregon

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CORRECTION

I would like to call your attention to two errors made on p 104 of the September issue. In the first column of the Indian Creek flowsheet, the secondary crushers are in closed circuit with the screens and not in open circuit as you have shown.

The second error is on the discharge of the two Denver jigs where the tails and concentrates have been transposed. The concentrate should be shown to flow to the dewatering cone and then to the pan filter, while the tails should flow to the two spiral classifiers.

Sincerely yours,
Herbert A. Hoffman

INTIMATE MIXING speeds reaction in one of eight 3384-gal. uranium oxide strip tanks equipped with turbine-type LIGHTNIN Mixers. Shown here is Baxter Blitz, Plant Engineer, Kermac Nuclear Fuels Corporation, Grants, New Mexico. For complete mixer details, request LIGHTNIN Catalog B-102.

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"Not one of our eight LIGHTNIN Mixers has given us any operating difficulties," says Plant Engineer Blitz.

This was no mere specification-matching choice of mixer. MIXCO people went to Kermac and came home to our lab with samples, plus answers to plenty of questions they'd asked.

Later, when they recommended 5-hp LIGHTNIN Mixers for these strip tanks, there was no question about efficient, dependable mixing—the kind Kermac needs and bought.

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No loopholes. We guarantee, unconditionally, that with our recommendation you can predictably blend ores in pulp form, mix slurries, condition feed for flotation cells, speed chemical reactions (as Kermac is doing), or solve other fluid-mixing problems—the one which you perhaps have in mind now.

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PERSONALS

Grover J. Holt, assistant to the president, Cleveland Cliffs Iron Co., and former president of AIME (1957), retired July 31. He now lives in San Clemente, Calif. where he will act as mining and metallurgical consultant.

From 1921 to 1928, Mr. Holt was mining engineer with Oliver Iron Mining Co. at Chisholm, Minn. In 1928, he became chief engineer, Manganiferous Iron Co. (Butler Bros.), Crosby. The next year, Holt was made assistant to the president of Butler Bros. and held the post until he joined Cleveland Cliffs in 1942.

During his years at Cleveland Cliffs, Holt was chief engineer; manager, Minnesota Mines; general manager of mines, Michigan and Minnesota; and assistant to the president.

Mr. Holt is a member of the Mining & Metallurgical Society of America, AIME, and the Marquette Range Engineers Club.

Dr. Joseph L. Gillson, chief geologist of E. I. du Pont de Nemours & Co., has been elected president, for 1960, of the American Institute of Mining, Metallurgical, & Petroleum Engineers.

Gillson

Dr. Gillson succeeds **Howard C. Pyle,** president, director and chairman of the executive committee of Monterey Oil Co.

AIME has named **Ronald E. McNaughton** to become president of the organization for 1961. He is manager of the metallurgical division of the Consolidated Mining & Smelting Co. of Canada, Ltd., and is a former AIME director.

New vice presidents of AIME are: **Dr. John Chipman,** head of MIT's department of metallurgy, now president of the Metallurgical Society of AIME; **Stanley D. Michaelson,** chief engineer of Western Mining Div., Kennecott Copper Corp., former president of AIME's Society of Mining Engineers; **Jerome W. Woomer,** head of the consulting firm of J. W. Woomer & Associates, now president of the Society of Mining Engineers; **Basil P. Kantzer,** vice president of Union Oil Co. of California, a former president of the Society of Petroleum Engineers of AIME; **John P. Hammond,** assistant general superintendent, production department, Amerada Petroleum Corp., a former president of the Society of Petroleum Engineers.

Dr. Walter R. Hibbard, Jr., manager of alloy studies research, General Electric Research Laboratory, a former president of the Metallurgical Society, now a vice president of AIME, has been re-elected for a second term.

New directors, until February, 1963, are **Raymond H. Feierabend,** assistant vice president, Freeport Sulphur Co., representing SME; **James C. Gray,** vice president, operations, coal, U.S. Steel Corp., also representing SME; **James B. Austin,** vice president, research and technology, U.S. Steel Corp., former president, American Society for Metals, representing the Metallurgical Society; **J. S. Smart, Jr.,** general sales manager, American Smelting & Refining Co., representing the Metallurgical Society; **Herbert F. Beardmore,** manager, gulf coast district, Gulf Oil Corp., representing the Society of Petroleum Engineers.

Lloyd E. Antonides, former E&MJ associate editor, is now mining engineer for Associated Metals & Minerals Corp., New York. He will be developing new sources of minerals and metals for the company's trading activities.

Antonides

Mr. Antonides graduated from Lehigh University as a mining engineer in 1948 and also completed an advanced civil engineering course at Syracuse University. Before joining E&MJ in 1955, he was exploration engineer for New Jersey Zinc Co. in Wisconsin, operations engineer at Warren Foundry & Pipe Corp.'s iron mine in New Jersey and previous to that worked as an assistant shaft-sinking foreman and surveyor.

Mr. Antonides is a member of AIME and the Society of American Military Engineers.

Dr. Raymond L. Smith, now technical director of the research laboratories of the Franklin Institute, Philadelphia, has been named head of the department of metallurgical engineering at the Michigan College of Mining & Technology.

Gillette N. Houck has been named assistant to the manager of the electrical conductor division, Kaiser Aluminum & Chemical Corp., according to a recent announcement by J. T. Dugall, division manager. At the same time, **Cecil R. Pickens** becomes division technical manager.

Dr. Carleton C. Long, research director, St. Joseph Lead Co., has been elected president of the Metallurgical Society of the AIME. He will take office during the Institutes annual meeting, New York, February, 1960

Long

Dr. Long succeeds **Dr. John Chipman,** head of MIT's department of metallurgy.

J. S. Smart, Jr., general sales manager, American Smelting & Refining Co., has been named vice president of the society and its president-elect. He has also been elected to a three-year term on the AIME board of directors.

Directors elected to the Metallugical Society board are: **A. W. Schlechten,**

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Personals *(Continued)*

professor of Metallurgy, Missouri School of Mines, for three years, representing the extractive metallurgy division; **Reinhardt Schuhmann, Jr.,** professor of metallurgical engineering, Purdue University, for one year coincident with his chairmanship of the extractive metallurgy division; **J. H. Scaff,** metallurgist, Bell Telephone Laboratories, for three years, representing the Institute of Metals division; **Thomas A. Read,** head of the department of mining and metallurgical engineering, University of Illinois, for one year, coincident with his chairmanship of the Institute of Metals division; **Karl L. Fetters,** vice president, Youngstown Sheet & Tube Co., for three years, representing the iron and steel division; **John J. Golden,** assistant to the administrative vice president, U.S. Steel Corp., for one year, coincident with his chairmanship of the iron and steel division.

Dr. Siegfried Muessig has been appointed chief geologist for U.S. Borax & Chemical Corp.

Before joining U.S. Borax, Dr. Muessig had been with the mineral deposits branch of the USGS for eight years. In 1951, he served with the Survey at Joplin, outlining exploration programs and writing reports. In 1952, he was transferred to Claremont, Calif., where he did general field work on the geology of saline deposits in the Mojave Desert then to Spokane where he was project chief.

K. O. Sweeney, metallurgist with the Anaconda Co., has been transferred from Montana to the firm's lean iron ore property near Nakina, Ontario. He will be in charge of the construction of a pilot plant and its operation.

The Society of Mining Engineers of AIME has elected **Dr. Arthur B. Cummins,** manager of central research, Johns - Manville Corp., to be president for the coming year. He will succeed **Jerome W. Woomer,** head of W. W. Woomer & Associates, consultants.

Cummins

James C. Gray was made president-elect, to take office in 1961. He is administrative vice president, raw materials, U.S. Steel Corp.

H. Carroll Reed, chosen western regional vice president for three years, is general manager, Inspiration Consolidated Copper Co., Inspiration, Ariz.

Others selected by SME to take office in February are: **Nathanial Arbiter,** School of Mines, Columbia University, director for three years, representing the minerals beneficiation division; **Sanford S. Cole,** assistant manager of research, National Lead Co., titanium division, director for three years, representing the industrial minerals division; **Donald A. Dahlstrom,** director of research and development, Eimco Corp., director for

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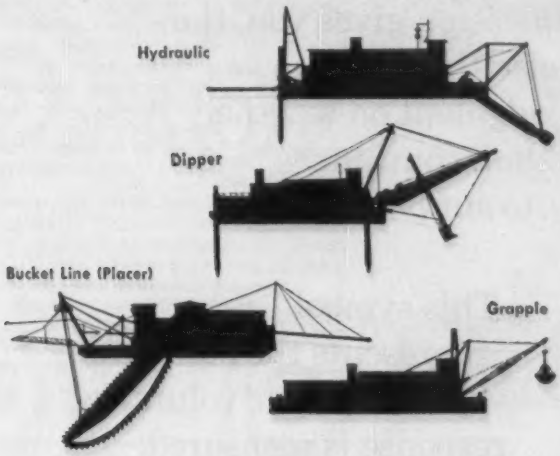

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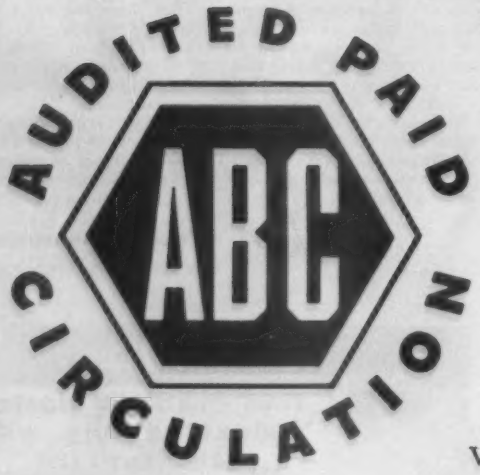

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Personals *(Continued)*

three years, representing the coal division; **Charles F. Park, Jr.,** dean of the School of Mineral Sciences, Stanford University, director for three years, representing the mining and exploration division; **Raymond D. Satterly,** general manager, ore mines, Inland Steel Co., director for three years, representing the mining and exploration division; **Prof. Ernest M. Spokes,** department of mining engineering, University of Kentucky, director for three years, representing the coal division.

Charles B. Hausen, assistant smelter superintendent for the Bunker Hill Co., was recently named to the newly created position of corrosion engineer. He will have the responsibility of the initiation, maintenance and evaluation of all corrosion protection programs for Bunker Hill on a company-wide basis.

Hausen joined the company in 1932. He became assistant smelter superintendent in 1955 after several years as superintendent of the various plant operating departments.

Walter R. Shaw has become project engineer, Western-Knapp Engineering Co., and will be responsible for design, layout, and process engineering on chemical and ore processing plants.

Shaw has more than 10 years experience in the chemical and metallurgical fields. Before joining WKE he was resident manager of a seawater magnesia and basic refractory material plant of the H. K. Porter Co., Inc.

Wayne D. Gould has been named to head the mining section of Dow Chemical Co.'s technical service and development department.

Gould

While making the announcement, **Jack D. Kerr,** TS&D unit head, said that the move is "part of a program to better service the mining industry in terms of Dow products and technical assistance."

The mining section will be responsible for laboratory and mill work on flotation and flocculating agents.

Gould, a former mill superintendent at the Sunshine Mining Co. in Kellogg, has been with Dow since 1957. He holds a degree in metallurgy from Washington State University and previously was a research metallurgist with the Braden Copper Co.

Robert M. Hansen, Salt Lake City, has been named Intermountain area business development engineer for Western-Knapp Engineering Co.

The Institution of Mining & Metallurgy has elected **Dr. David Williams,** D. Sc., Ph.D., B.Eng., D.I.I., as its president for 1960-61. Dr. Williams occupies the University of London chair of mining geology at the Imperial College of Science & Technology.

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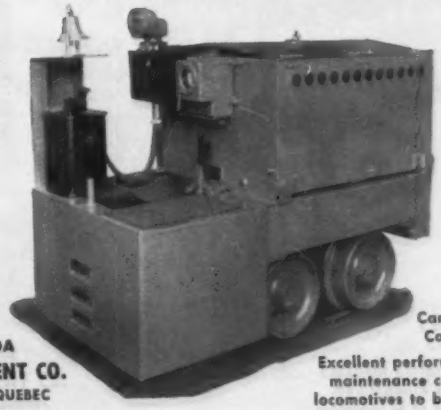

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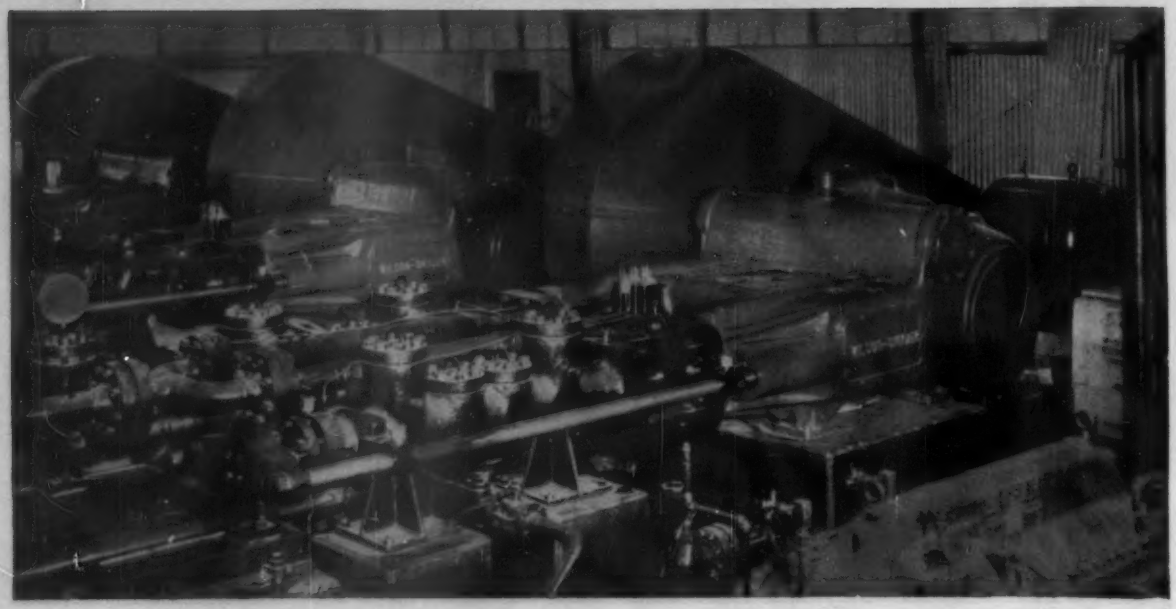

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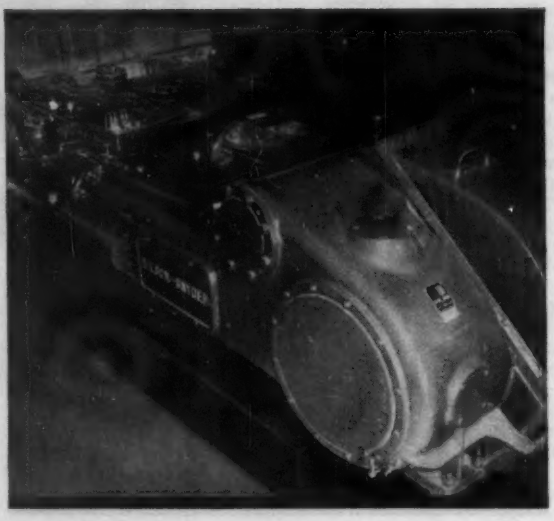

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Robert W. Lawson was appointed branch manager for Ingersoll-Rand Co. at Buffalo. He joined the firm in 1937 and has been branch manager at Salt Lake City since 1953.

Succeeding Mr. Lawson at Salt Lake City is **Robert L. Olund.** He also joined the company in 1937 and has been manager for Ingersoll at Butte.

E. K. Leavenworth has been appointed a vice president of Climax Molybdenum Co. of Michigan. He will continue to be headquartered at the company's Coldwater, Michigan, plant where he serves as works manager.

John C. Russell has been appointed manager of metallurgical engineering for Sigmaster & Breyer, Inc., New York metallurgical and chemical engineers. He had previously been a project engineer for the firm on a plutonium laboratory for the Argonne National Laboratory.

John M. Haivala is the new general superintendent of mines, Chino Mines Div., Kennecott Copper Corp., according to an announcement by **E. A. Slover,** general manager. He succeeds **G. J. Balmer,** who retired July 1.

Haivala worked for Cleveland Cliffs Iron Co. in various capacities for the past 18 years. In 1953, he was named assistant superintendent of the Cleveland Cliffs Spies mines and later was appointed superintendent. In 1956, he was chosen to organize and head a new department of operating research. More recently, he has been assigned to special projects for the company.

Fifteen leading Asian geologists and mining experts, including **Dr. Tatsu Kaneko,** director, geological survey of Japan, and **Mr. Goro Mori,** chief, mining industry section, mines bureau, Japan, will study mining methods, techniques and equipment both in the U.S. and Canada and the application of these techniques to Asian geology.

The tour is jointly sponsored by the U.N. Economic Commission for Asia and the Far East (ECAFE) and the U.N. Assistance Operation in New York. The U.S. International Cooperation Administration (ICA) will be responsible for arranging the U.S. part of the tour, while the Technical Cooperation Service of the Department of Trade & Commerce of the government of Canada will take charge of the tour's other part.

Ernest E. Thurlow has become chief mining geologist for the Northern Pacific Railway Co., with headquarters at St. Paul. He succeeds **Donald W. Lindgren.**

Richard W. Flagg, assistant director of the Denver ore testing division, Denver Equipment Co., for the past two years, has been promoted to chief metallurgist.

Before joining Denver Equipment Co., Mr. Flagg was a research and development engineer with Dorr-Oliver and previously had been a metallurgist with the Miami Copper Co., Arizona.

Mr. Flagg predecessor, **H. J. Gisler** was promoted to manager of the company's eastern sales division.

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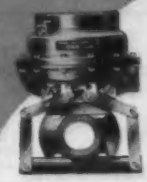

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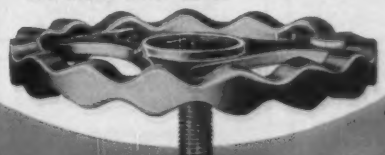

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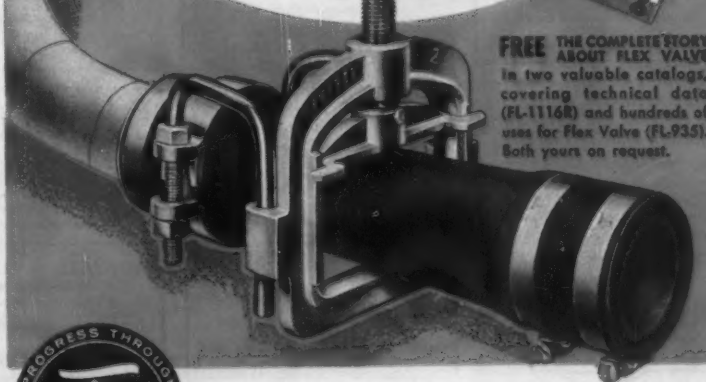

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46 TD 13418	22½ tons	Lancaster, Penn.
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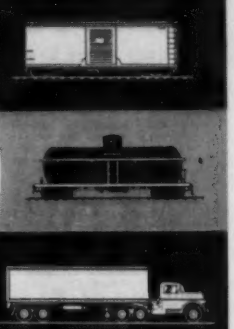

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engine power BY CATERPILLAR

Why White Canyon Mining Co. chose a Cat Engine for a remote uranium mine

"Dependability" was the big factor in favor of this Caterpillar D342 when White Canyon specified engine power for their uranium mine. This engine has performed well for over two years at the No. 1 Mine.

White Canyon Mine No. 1, located 54 miles west of Blanding, Utah, relies on a Cat D342 . . . the same as their Hide Out Mine on Deer Flat. Why? . . . because these remote mines cannot "baby" their power source, they must have dependability.

Foreman Lester J. Hancock says, "When we consider equipment we must have dependability as well as operating and maintenance economy. In the faraway places we must have engines that will run and get the work done."

White Canyon No. 1 is a drift mine, the main tunnel being 750 feet long. Loading at the faces is accomplished by a Caterpillar No. 933 Traxcavator, ore is removed by truck.

Cat Engines are good for underground or tunnel work because of their complete combustion system, clean exhaust, and relatively low ventilation requirements. More and more mines and tunnel jobs specify Cat Engines in locomotives, shuttle cars and loaders for these reasons. Ask for Cat Diesel power for above-ground or underground applications, whether you need electric sets or other mining machinery. Most all quality-conscious equipment manufacturers offer Cat power. For a listing of manufacturers' machines powered by Cat Diesels, send for Form No. 20153.

CATERPILLAR

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

White Canyon No. 1 produces 75 tons a day from flat drifts extending into this hillside.

Caterpillar Diesels with suitable exhaust conditioners help make the Traxcavator a popular underground machine.

Foreman Hancock here shows .28 uranite with small copper content from White Canyon No. 1 Mine.

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3 new applications get longer life and minimum maintenance using Dodge pillow blocks with Timken® bearings

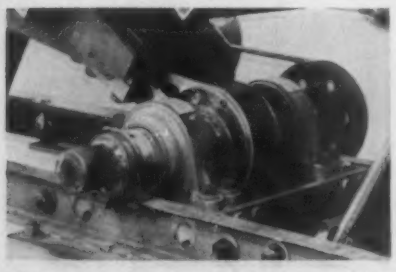
PICTURED below are three applications where Timken bearing equipped Dodge pillow blocks stay on the job with little attention under tough conditions. Their tapered design lets Timken® bearings take *both* radial and thrust loads in any combination. And full-line contact between rollers and races provides extra load-carrying capacity. Wear is reduced, maintenance is cut to the minimum.

Cutaway view shows the Dodge All-Steel pillow block with Timken bearing mounting. Of special design, the bearing has a tapered bore with self-aligning spherical outer surface —never needs adjustment.

Besides the All-Steel pillow block, other versatile Dodge pillow blocks with Timken tapered roller bearings are: Type "E", Double-Interlock, Type "C" and Special Duty. All are compact in design. Special thrust devices that take up extra space are not needed.

Timken bearings bring Betterness to any machines because Betterness rolls on Timken *tapered* roller bearings. So specify bearings trademarked "TIMKEN" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



Timken bearing-equipped Dodge All-Steel pillow block used in a vibrating conveyor.

Timken bearing-equipped Dodge Type "E" pillow block used in sand and gravel plant.

Timken bearing-equipped Dodge "Special Duty" pillow block as used on fine paper machine lineshafts.

TIMKEN TAPERED ROLLER BEARINGS ROLL THE LOAD

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